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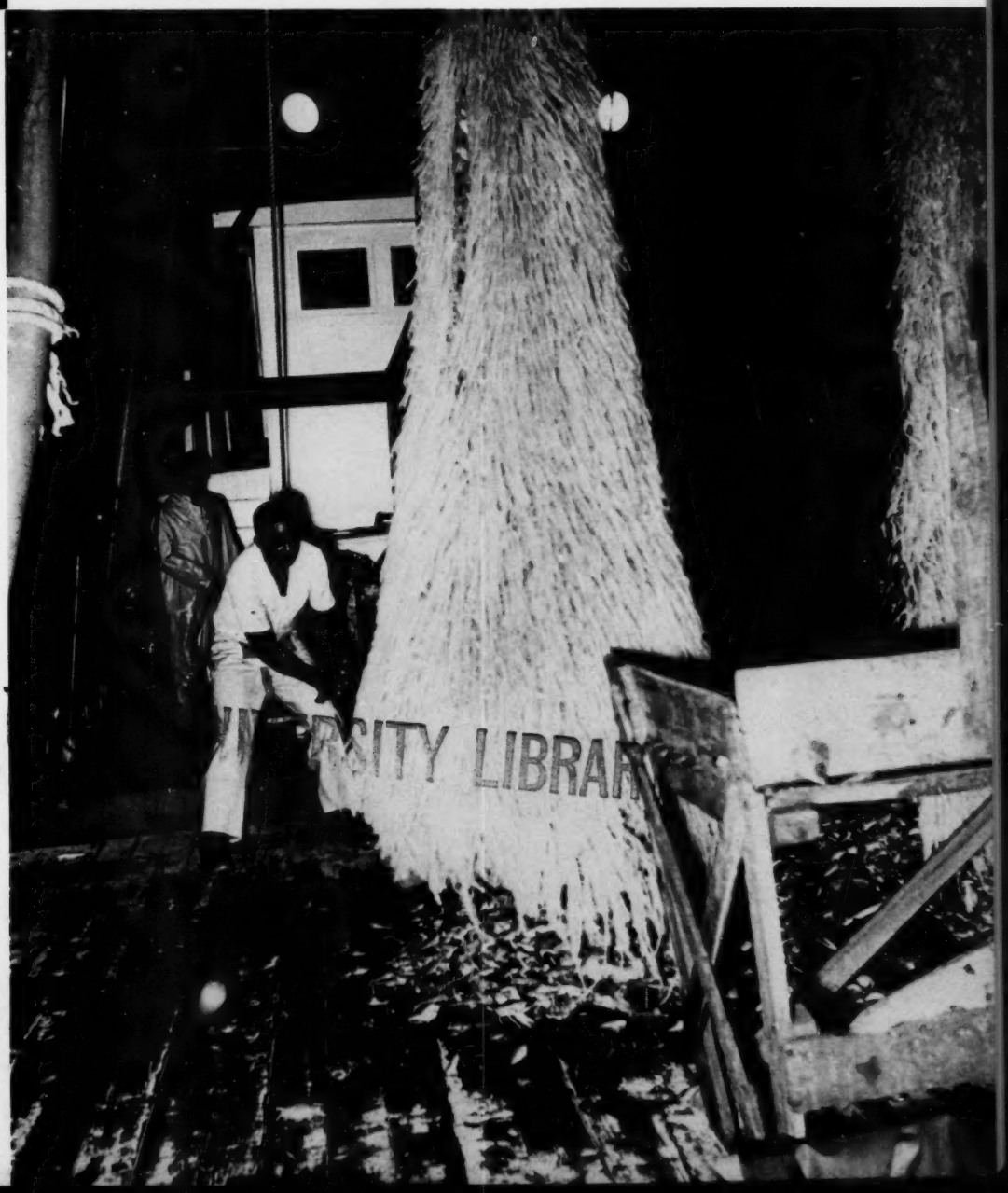
Marine Fisheries REVIEW

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service



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FRONT COVER: A shower of shrimp falls on a Beaufort, N.C., vessel.

BACK: The "Dudley" sets its shrimp net off Beaufort, N.C.

(Photos: Bob Williams)

FISHERMEN'S MEMORIAL - GLOUCESTER, MASS.

U.S. DEPARTMENT OF COMMERCE
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THE MARINE FISHERIES REVIEW

With this issue we have set forth a new role for the former Commercial Fisheries Review, a new role that requires a new name: Marine Fisheries Review.

In the 34 years of its existence, CFR has performed a valuable service to its readers, providing, to quote from the masthead of the last issue, "A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the National Marine Fisheries Service." It was the creation of NMFS as part of NOAA less than two years ago that led to the action we have taken. NMFS has a much broader charter than its predecessor agencies, for it includes not only the old Bureau of Commercial Fisheries but the Migratory Marine Game Fish Program from the Department of the Interior's Bureau of Sport Fisheries and Wildlife as well. The Service is resource-oriented rather than user-group oriented, at the same time it maintains full regard for the legitimate needs of all user groups, the two major ones being, of course, commercial fisheries and marine sport fisheries.

Obviously, there is no hard line separating sport from commercial fish. Many, if not most species are of interest to both groups, though others are sought only by one or the other. Consequently research cannot rationally be divided into "sport" and "commercial" components. Rather, we must study fish populations as biological units interacting with each other and their environment. To this end our research programs and fishery laboratories and centers are integrated--there are no sport fish or commercial fish laboratories or centers, though there are of course projects of primary interest to either sport or commercial fishermen forming part of every major research program conducted by NMFS.

Allocation within and among user groups is a separate problem, but one which requires, for rational solutions, as complete an understanding of population dynamics and environmental factors as we can get. Our major new effort, the State-Federal Management Program takes full cognizance of the long-standing and often deep conflicts between commercial interests and sportsmen. Unfortunately, these conflicts are often serious, deep-rooted and bitter; they can only be resolved by perhaps equal amounts of knowledge, faith and goodwill. We hope to provide the former, and at least an atmosphere in which the latter can be nurtured. Marine Fisheries Review is a vehicle which we plan to use toward this end.

--Philip M. Roedel, Director
National Marine Fisheries Service

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ATLANTIC SALMON AIDED BY RECENT ACTIONS

More "significant and constructive" actions were taken from December 1971-May 1972 to protect the Atlantic salmon than in the previous decade. This is the theme of the editorial in the May 1972 Newsletter of the International Atlantic Salmon Foundation signed by its Executive Director, Wilfred M. Carter.

He lists these important developments:

o December 1971--President Nixon signed a bill authorizing restrictions on imports from nations "conducting fishing operations in a manner or under circumstances which diminish the effectiveness of an international fishery conservation program."

--A U. S.-Canadian statement urged an end to high-seas fishing for Atlantic salmon.

o February 1972 --Denmark and the U.S. announced an agreement. Denmark would phase out its "high-seas salmon fishery" by 1976. It would "maintain the fishery for Atlantic salmon by local Greenland fishermen at approximately 1100 metric tons annually."

o April 1972 -- Canada announced an immediate prohibition on the catching of Atlantic salmon by commercial fishermen over large areas.

o May 1972 -- Quebec Province banned commercial fishing for salmon for the entire Gaspe Peninsula. Beginning in 1973, in an area from the North Shore as far east as Sept Iles, she will not issue permits to persons who are not bona fide salmon fishermen.

-- At the annual meeting of the International Commission for the Northwest Atlantic Fisheries (ICNAF), the U.S. introduced a resolution embracing the substance of the Danish-U.S. agreement.

Canada strongly opposed the resolution. She said it offered "too little, too late." The Canadians argued that "the proposed phase-out is over too long a period (1972-1976) and the permissible inshore Greenland catch (1100 metric tons) is too high." They proposed an amendment that would end the high-seas fishery by March 1, 1973. The U.S. proposal was adopted.

Canada catches about 95% of the North America Atlantic salmon taken off Greenland.

Mr. Carter's editorial concludes: "We view recent events with satisfaction and believe that very substantial progress has been achieved toward the ultimate goal of that prohibition of the high-seas fishing for Atlantic salmon and the recognition of preferential harvesting rights for coastal producing states . . . The United States and Canada have publicly stated that they intend to cooperate closely and be mutually helpful in future programs for restoration and rehabilitation of Atlantic salmon runs in North America. There could be no more propitious moment to begin than right now."

IASF HELPS NORTH AMERICAN COUNCIL

The International Atlantic Salmon Foundation (IASF) provides the Secretariat for the North American Salmon Council (NAASC). The Council was formed in December 1971 to serve as a means for Atlantic-salmon conservation groups to pool their resources and knowledge.

The 15 member organizations of NAASC are: American Fisheries Society, The Atlantic Salmon Assoc., Bail des Chaleurs Salmon Assoc., Canada Wildlife Federation, The Conservation Foundation, Federation of Fly Fishermen, The International Atlantic Salmon Foundation, The Izaak Walton League of America, The Miramichi Salmon Assoc., National Wildlife Federation, Nova Scotia Salmon Assoc., Sport Fishery Research Found., Sport Fishing Institute, Trout Unlimited, and World Wildlife Fund.

FISHERMEN AND NMFS SEARCH FOR ALBACORE

This season, U.S. west coast fishermen are finding that albacore, the prized white-meat tuna, are scattered in pockets from northern Baja California to Vancouver Island. Although these pockets frequently produce high catches, the fishing often slacks off after several days and the fishermen have to search for new productive areas.

This unusual pattern of albacore distribution may be caused by extensive mixing of northern and central Pacific waters far offshore, says Dr. R. Michael Laurs, Leader, Fishery-Oceanography Investigations, NMFS Southwest Fisheries Center, La Jolla, Calif. This is one of the interesting facts emerging from the cooperative research surveys recently completed by La Jolla in association with the American Fishermens Research Foundation (AFRF). The two groups explored an area 400 to 1,200 miles off the Pacific west coast to locate the path followed by albacore tuna in their annual migration from the central Pacific to the nearshore fishery.

The Operation

The current program was coordinated in San Diego, Calif., by Dr. Laurs and Robert Insinger, AFRF Director. NMFS dispatched its research vessel "Townsend Cromwell" to take oceanographic measurements in June in this far-offshore region west of northern California to south of Ensenada, Mexico. Four albacore jig boats, chartered by AFRF, left San Diego on May 22; four more left on June 1 for 35-40-day cruises; an additional four boats left Astoria, Oregon, on June 15. The first albacore of the season was taken May 29 about 840 miles west of Ensenada, Mexico, by the "Typhoon", an AFRF charter boat.

Aboard the Cromwell, Ron Lynn, oceanographer, led a team of NMFS technicians in obtaining chemical and biological measurements of the ocean environment. This information was passed rapidly to the AFRF boats to assist them in locating favorable albacore fishing areas.

Contrast with 1971 Season

Lynn directed an albacore survey cruise in the same region in 1971 aboard the NMFS research vessel "David Starr Jordan". This year he reported that ocean conditions are markedly different. In 1971, there appeared to be little mixing between north and central Pacific waters, and the boundary between them was sharply defined. The Jordan's albacore catches in 1971 were limited to a zone just north of the boundary between the two waters. The 1971 albacore season developed in a typical manner along the coast from northern Baja California to Vancouver Island.

In contrast, this fishing season's oceanographic conditions are complicated. Large-scale eddies and wavelike features indicate mixing of northern and central Pacific waters. Thus far, the distribution of albacore catches along the Pacific coast has shown a similarly complicated pattern: small-to-moderate catches of fish scattered over a broad region, possibly in response to these oceanographic conditions.

Tag and Release 1,458 Albacore

While they made ocean temperature and color observations, the AFRF-chartered albacore vessels, half with NMFS fishery technicians aboard, measured, tagged, and released 1,458 albacore. Dr. Laurs says that the recovery of the tagged fish will help NMFS biologists understand the movements of albacore within the U. S. fishery; also, they will learn the proportion of fish that return to the U. S. fishery in later years. The tag returns will provide information on albacore mortality for La Jolla's population dynamics studies.

The discovery of commercial concentrations of albacore by the chartered vessels about 900 miles due west of Los Angeles indicates, Dr. Laurs believes, that fishermen can fish albacore profitably earlier in the year and further offshore than ever before.

POTENTIAL MARKET FOR SHRIMP HEADS?

Dov Grajcer

A method of preserving shrimp heads that may lead to expanded use of shrimp processing wastes in animal feeds has been discovered at the National Marine Fisheries Service Galveston Biological Laboratory.

The usual methods of stabilizing the powerful enzymes present in shrimp processing wastes are to heat or dry the wastes. Unfortunately, these methods destroy some of the nutritive value of the wastes, particularly the nutritive value to other shrimp.

As part of studies of sexual maturation in shrimp conducted at the Galveston Laboratory, a food was formulated to encourage rapid growth and sexual development. A major ingredient of this food is shrimp heads collected from a local shrimp processing plant. It was noted that the rapid breakdown of the heads caused by powerful enzymes could be halted by destruction of these enzymes with acid.

The treatment used to destroy these enzymes follows:

1. Fresh or frozen shrimp heads are ground and treated with concentrated hydrochloric acid until the pH of the mixture reaches 1.8. This mixture is allowed to stand 6 to 24 hours at room temperature.

2. A base such as ammonium hydroxide or sodium hydroxide is added to the mixture until it reaches a neutral pH (7.0).

3. Supplemental nutrients are added if desired. The shrimp feed being used in these maturation studies includes 1% cholesterol, 0.2% corn oil, 2.4% dextrose, and 1% vitamin mixture.

4. The mixture is bound with 5% gelatin, which is dissolved in warm water and added to the other ingredients. After the ingredients are mixed, they are placed in a refrigerator to gel.

5. The solid feed is cut into pieces of convenient size and dried in an air tunnel at room temperature.

Cholesterol is added to this experimental feed which is being used for studies of sexual maturation because it is suspected to be an essential precursor of some shrimp hormones. It may not be needed in this quantity in growth formulations.

The analysis of feed produced using this technique is:

	Percent
Protein	45.87
Fat	3.90
Moisture	34.69
Chlorides	2.86
Calcium as CaO	5.37
Phosphate as P_2O_5	1.81
Ash	12.28

The feed contains a high concentration of salt, which might limit its usefulness in some feeds, particularly if the shrimp heads made up a high proportion of the feed. However, the salt content of the feed developed at Galveston apparently has no adverse effects on shrimp. Growth rates of brown shrimp (Penaeus aztecus) fed this feed alone ranged from 80 mg to 110 mg per day between the sizes of 50 and 95 mm (total length).

The use of this technique may make shrimp processing wastes a more valuable feed supplement, thereby providing a market for wastes presently not utilized.

The author is a Fishery Biologist, NMFS Biological Laboratory, Galveston, Texas 77550.

Contribution No. 342.

CRAB-PICKING MACHINE IS PICKUP FOR INDUSTRY

A new crab-picking machine promises to be a significant economic boon to crabmeat producers, and to consumers, says Philip M. Roedel, Director of the National Marine Fisheries Service (NMFS).

"Not only does the ingenious new machine recover 30 to 50 percent more crabmeat from shells, it does the job much more rapidly and efficiently than traditional hand-processing can." He adds that tests have shown that the machine converts 1,000 pounds of crabs in shells into about 400 pounds of shell-free meat in an hour.

The process is based on the principle of centrifugal force, a technique used in manufacturing to separate liquids from solids. Crab bodies and legs are chopped mechanically into pieces that will yield meats of a selected size. The pieces are fed into the machine in a brine solution. A rotating bowl generates centrifugal forces that separate meat from shells because of differences in specific gravity. The shells are heavier and are discharged from one end of the machine; the lighter meat floats out the other. Fresh water quickly rinses off the brine.

Background

NMFS has been working on the new design with a New England commercial machine company for the past two years. The idea was conceived and tested in 1970 at the NMFS laboratory in Seattle, Wash. Throughout 1971, it was advanced at NMFS Gloucester, Mass. Here numerous tests using many crab species were conducted. The machine was put on the market about six months ago. Since then, seven have been ordered by companies in Alaska, the Chesapeake Bay area, Halifax, N.S., and Seattle.

Great Promise

The researchers believe the apparatus promises a large increase in production of all kinds of crabmeat. These range from presently harvested blue, dungeness, king, and tanner to red, rock, and sand crabs, presently underutilized because processing costs are too high.

Also, the machine can enlarge the yield of meat from lobsters -- particularly from rock lobsters. At present only rock's tail is used. The machine also is able to strip cooked fish frames efficiently. The reason for this is that chunks of meat picked are larger, and so are more attractive to consumers, than those resulting from other methods.

The machine is adaptable to clam shucking. The model is being used by a Chesapeake Bay firm to recover much more meat from catches of surf clams.

The Economics of It

The stainless steel centrifuge and drive system cost about $16,000. The chopping and feeding devices cost another $5,000-6,000. Costs for brine, power, and labor are negligible. Repeated experiments suggest the investment can be recovered in one picking season.

Tests have shown that half the available crabmeat is wasted in conventional methods. Added to that hidden loss is the high cost of labor: 30 to 60 cents a pound of hand-picked meats, depending on region. Another favorable factor is that the process requires little space. The machine needs only 4 by 4 feet of floor space and 6 feet of headroom. To match this output, a firm would need space for 60 people lined up at tables covering 30 by 50 feet of floor space.

Consumer Benefits

Consumers should profit. The process makes available a new supply of potentially cheaper seafood. The only real difference between a pound container of prime crabmeat and one of pieces produced by the machine is the size of meat chunks. But in nutritional value and taste, each pound is equal.

ROTHSCHILD NAMED DIRECTOR OF NMFS SOUTHWEST FISHERIES CENTER

On July 5, Dr. Brian J. Rothschild, 37, became Director of the Southwest Fisheries Center (SWFC), La Jolla, California. SWFC includes laboratories in La Jolla and Honolulu. Its scientists conduct fishery and oceanographic research in the central and eastern Pacific. Dr. Rothschild succeeds Dr. Alan R. Longhurst, who took a high-level fishery post in his native England. Directing the extensive activities of SWFC in the interim before Dr. Rothschild's appointment was Izadore Barrett, biologist and administrator.

Scientist and Teacher

Dr. Rothschild has worked for the federal fishery service for almost 8 years. Most recently, he was Deputy Center Director, Northwest Fisheries Center, Seattle, Washington. From 1962 to 1968, he served at the NMFS Honolulu Laboratory. From 1968 until 1971, he taught at the University of Washington. He returned to NMFS in September 1971.

Dr. Rothschild is the author of 45 publications, a member of 11 professional societies, and has served many working groups and committees, domestic and international, in fishery research and oceanography.

A native of Newark, New Jersey, he earned his B.S. at Rutgers University, M.S. at University of Maine, and Ph.D. and postdoctoral degrees at Cornell University. He has taught at the University of Hawaii.

BIOLOGIST AT LA JOLLA LAB SEEKS TO DEVELOP ARTIFICIAL FISH FOOD

"Some of the small anchovy larvae now being reared in the experimental aquarium at the NMFS Southwest Fisheries Center Laboratory in La Jolla, California, may grow to adulthood without ever eating any of the small planktonic crustaceans which form the natural food of their wild cousins in the ocean," the lab states. This is the objective of Douglas E. Conklin, 30, a biologist awarded the first NMFS National Research Council Research Associateship. He will attempt to develop and test a laboratory-prepared microencapsulated food for northern anchovy larvae. The Center provides for postgraduate scientists and engineers to work on basic research problems with its professional laboratory staff.

Superb Aquarium-Laboratory

Mr. Conklin will work in one of the largest and best equipped sea-water aquarium-laboratories. A broad research program on the physiology of marine fishes and their food organisms is in progress under the direction of Dr. Reuben Lasker, physiologist. Staff scientists are measuring the effects of such environmental factors as salinity, temperature, and pollutants on the growth and survival of larval fishes. They are exercising large fishes in special tanks to observe physiological and behavioral changes. They are developing successful techniques for spawning and rearing marine fishes for experimental work and mariculture.

Manmade Food Important

Dr. Lasker explained the importance of having manmade food particles available. The particles are buoyant, nutritious, and sized for the small mouths of first-feeding larvae. They will free scientists from the necessity of capturing and culturing planktonic organisms to feed the fish larvae. The particles will open a vast area of study into the nutrition and development of many marine fishes which, historically, have been difficult to maintain in the laboratory or in hatcheries.

Dr. Oscar Sette, Distinguished Marine Scientist, Is Dead

Dr. Oscar Elton Sette, who made major contributions to marine science for half a century, died on July 25, 1972, at Palo Alto, California. The 72-year-old fishery scientist, administrator, and teacher was one of the pioneer researchers in the Pacific and Atlantic Oceans. He was among the first to integrate fishery biology with oceanography and meteorology.

He was born in Clyman, Wisconsin, in 1900, earned his B.A. in Zoology at Stanford University in 1922, his M.A. in Biology at Harvard University in 1930, his Ph. D. in Biology at Stanford in 1957.

In 1929, he went to work for the State of California in the field of marine scientific investigation. In 1924, he joined the U.S. Bureau of Fisheries (a precursor of the National Marine Fisheries Service). For the next 48 years, he held prominent positions as a Government scientist and administrator. He was an expert on mackerel, sardines, and tuna.

International Roles

Dr. Sette was instrumental in organizing and administering the Pacific Tuna Conferences and the Eastern Pacific Oceanic Conference in the 1950s. He was a U.S. delegate to the International Technical Conference on Living Resources of the Seas, Rome, 1955; adviser to the U.S. delegation at the Fisheries Conference, Santiago, Chile, 1955; and a delegate to the Law of the Sea Conference at Geneva, 1958.

Honored

In 1961, Dr. Sette received Interior Department's highest honor, the Gold Medal for Distinguished Service. The Secretary said: ". . .He has always placed special importance on the training of scientists. . .These efforts have had an important influence upon fishery science in the United States and Canada."

In December 1971, NMFS Director Philip M. Roedel wrote a dedication for the "Oscar Elton Sette" issue of the NMFS Fishery Bulletin: "With this issue we honor as best we can someone who has earned the respect and admiration of those fortunate enough to have crossed his path during a long and most honorable career. He is in the truest sense a gentle man."

On his death, Dr. Sette was consultant and adviser to the NMFS laboratory at Tiburon, California, in charge of the ocean ecology unit.

'ARTIFICIAL OCEAN' WILL TEST OIL-SPILL CLEANUP METHODS

An "artificial ocean" containing its own wavemaking machinery will be built in New Jersey by the U.S. Environmental Protection Agency (EPA) to test equipment designed to clean up spills of oil and other hazardous materials. The world's first, this concrete test tank costing $1.8 million will be 600 feet long and hold more than two million gallons of water.

It will be built on 5 acres of marshland on the south shore of Raritan Bay. May 1973 is the completion target. Its name: OHMSETT (Oil and Hazardous Materials, Systems Environmental Test Tank).

The Facility

The facility will test new types of booms, skimmers, and other devices used to contain and clean up spills. To approximate realistic conditions, OHMSETT will have a wave generator to produce regular, irregular, and "confused" waves up to two feet high. The tank, 65 feet wide and 8 feet deep, will hold about 2.6 million gallons of water drawn from Raritan Bay. A tracked bridge spanning the tank will tow test equipment lengthwise down the tank at speeds up to six knots.

Helpful Data

The data collected will be transmitted to a small control building for recording and processing. Water-quality analysis will be done in a small lab near the tank.

The data will help EPA reduce the harmful impact of accidental discharges of hazardous pollutants upon beaches and the marine environment. These spills have become a major problem for U.S. lakes and coastal waters. In 1970, the U.S. Coast Guard recorded 3,335 oil spills (about 15 million gallons) and hundreds of spills of hazardous materials totaling about 250,000 gallons.

EPA Precautions

Because OHMSETT will operate continuously with oil and other hazardous materials, EPA is insuring that the tank does not harm the environment. Wastewater, oil, and other materials from the tank will be piped directly to an adjacent treatment facility; the effluent from there will be of higher quality than the water pumped in from Raritan Bay. Oily portions separated from the wastewater will be refined. Solids will be stored and transferred later to State-approved landfill site.

NOAA SIMPLIFIES WAYS TO CALCULATE TIDAL CURRENT SPEED

NOAA has developed a simplified method to calculate the speed of tidal currents in bays, estuaries, and harbors as an aid to mariners. The new method is to be used along with the tidal current charts published by NOAA's National Ocean Survey.

At present the mariner spends time calculating the speed of a current at any given time. These computations are sometimes difficult for inexperienced boaters and lead to error.

Demetrio A. Dinardi, developer of the new method, says it can be learned quickly by any inexperienced boatsman. The system depends on computerized diagrams, one for each month of the year. The diagrams identify which chart to use and make it easy to compute the speed of the current.

The first diagrams are for use with the tidal current charts for Block Island and Long Island Sound. Later, it is planned to publish similar diagrams for use with other tidal current charts. At present, tidal current charts have been published for Boston Harbor, Narragansett Bay to Nantucket Sound, Narragansett Bay, New York Harbor, Delaware Bay and River, Upper Chesapeake Bay, Charleston (S.C.) Harbor, San Francisco Bay, Puget Sound (Northern Part) and Puget Sound (Southern Part).

A set of 12 diagrams for use with tidal current charts for Block Island and Long Island Sounds can be obtained for $1 from National Ocean Survey (NOS) Distribution Division (C44), Washington, D.C. 20235, or from NOS nautical chart sales agents.

U.S. FISHERIES: A View of Their Status & Potential

John P. Wise

In 1959, the 178 million people of the United States used about 3.8 million metric tons (live-weight basis) of commercial fishery products. By 1971, the population had increased to 207 million, and the amount of fishery products used had increased to 5.3 million tons. During those 13 years, population increased 16%, but the amount of fishery products used increased 26%.

About 60% of the total used in 1959 was landed by U.S. commercial fisheries (Tables 1 and 2). The amount U.S. commercial fisheries produced in 1971 was almost identical to that in 1959, and only 12% more than 1939. It accounted for only a little better than 40% of the total used. During those 13 years, the U.S. passed from producing well over half the fishery products it used to producing well under half (Figure 1).

Edible & Industrial Fishery Products

U.S. landings of edible fishery products have remained close to 1.1 million tons a year for many years. No recent landings have approached the 1.5 million tons of record year 1950. Imports of edible fishery products have nearly doubled since 1959, from less than a million tons to 1.6 million tons.

Domestic production of industrial fishery products has averaged about a million tons a year since 1959. Imports of industrial fishery products have doubled in 13 years, from less than a million tons in 1959 to about 1.5 million tons in 1971 (the record, 4.5 million tons, was set in 1968).

Southeastern Landings Rise

The relatively constant level of the U.S. commercial catch for 30 years or so masks major changes in U.S. fisheries. Landings in the southeastern states have been increasing while fisheries in most other parts of the U.S. except Alaska have been decreasing. In the early 1930s, the Gulf of Mexico and South Atlantic areas produced less than 200,000 metric tons a year, about 10% of the commercial catch. As late as 1950, landings in the region were less than 400,000 tons, 20% of the total. In 1971, production surpassed a million tons, nearly half the total U.S. commercial production. A large part of the increase is due to development of menhaden fisheries in the Gulf of Mexico--from about 3,000 tons a year in the 1930s to an average of over 470,000 tons a year in 1965-71. (See "Gulf and South Atlantic Fisheries," Commercial Fisheries Review, March-April 1972.)

Per-Capita Consumption & Use

Increased utilization and importation of fishery products in the U.S. are related to increase in population. The relation between population and fishery supply is perhaps best reflected in consumption and utilization per capita (Figure 2, Table 3). Annual per-capita consumption of fishery products since 1951 has been relatively constant at about 5 kilograms. Per-capita utilization, which includes inedible industrial fishery products, increased from about 20 kilograms in the 1950s to a peak in 1968; it has remained around 25 or 26 kilograms for the last three years. The marked fluctuations in importation and utilization of industrial fishery products are closely related to demand for fishmeal, used principally as a supplement in poultry feeds. The amount of fishmeal imported is an involved function of price, domestic and foreign supply, price of other feedstuffs, prices of poultry products, etc.

Catches Rise In U.S. Waters

U.S. commercial fishery production has been stable for many years, but total catches in waters near the U.S. have increased dramatically in the last 10 years or so.

The author is a Fishery Biologist, National Marine Fisheries Service, Southeast Fisheries Center, Miami Laboratory, Miami, Florida, 33149. The opinions in this article are his.

SEFC Contribution No. 213.

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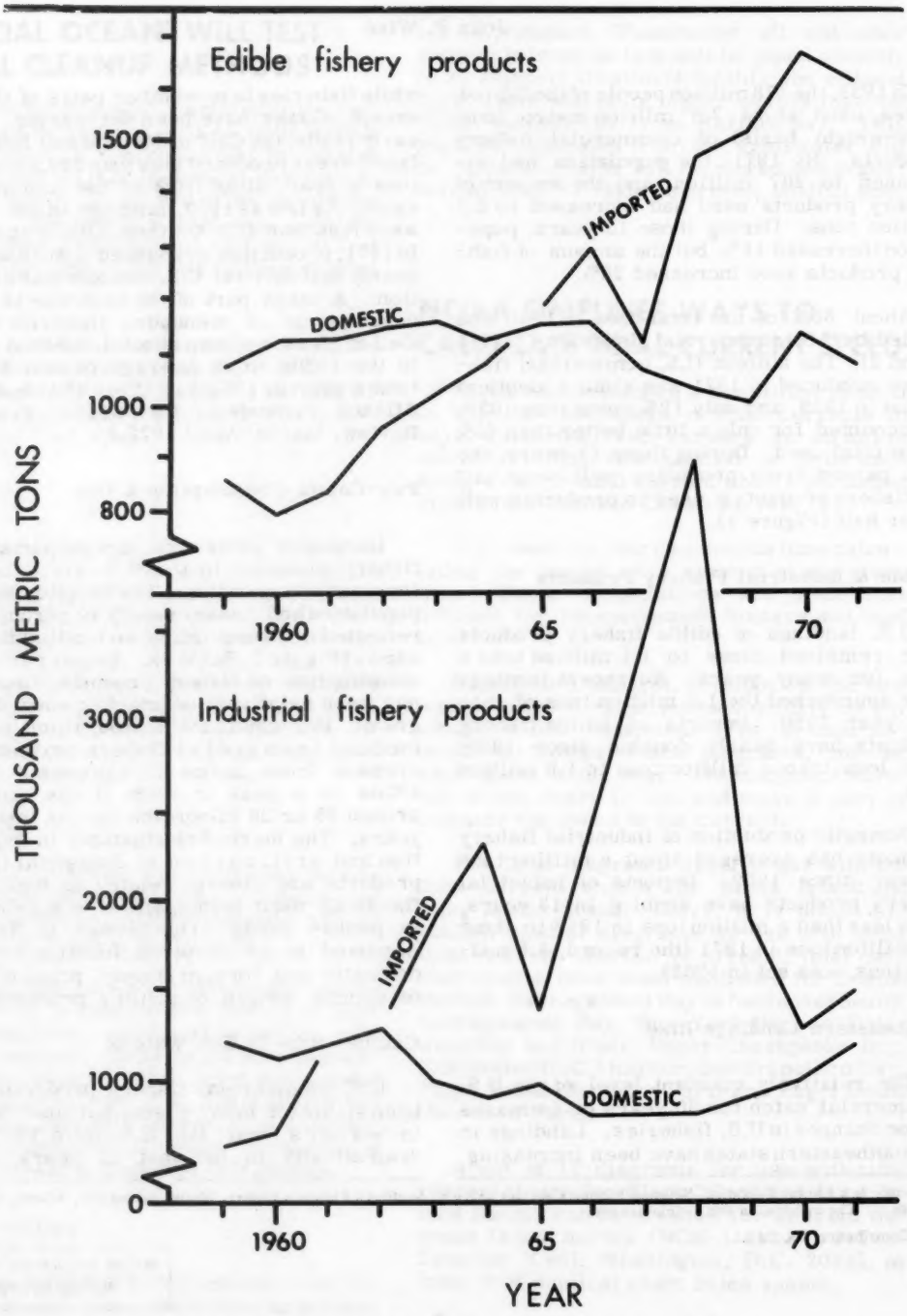

Fig. 1 - U.S. supply of edible and industrial fishery products, 1959-71.

Table 1 - U.S. supply of edible fishery products, 1959-71.

Year	From domestic sources	Imported	Total
	- - (thousand metric tons, round fresh)- - -		
1959	1,074	862	1,936
1960	1,133	801	1,934
1961	1,129	837	1,966
1962	1,152	959	2,111
1963	1,159	1,019	2,178
1964	1,132	1,078	2,210
1965	1,173	1,168	2,341
1966	1,167	1,297	2,464
1967	1,074	1,125	2,199
1968	1,041	1,466	2,507
1969	1,019	1,521	2,540
1970	1,136	1,667	2,803
1971	1,088	1,624	2,712

All 1971 data are preliminary.

Japanese and Soviet catches of Alaska pollock, many if not all in eastern Bering Sea, increased from about 230,000 metric tons in 1961 to over 2.5 million tons in 1969. Canadian and other foreign catches of Atlantic herring in waters near the U.S. were just over 100,000 tons in 1960, but almost 700,000 tons in 1969. Japanese and Soviet fisheries for ocean perch and rockfish started only in the early 1960s; in 1965, they took over 450,000 tons in the Gulf of Alaska and off Washington and Oregon. Foreign catches of red hake off U.S. Atlantic shores were over 100,000 tons in 1965, up from nearly nothing in 1962. Soviet catches of Pacific hake near the U.S. commenced in 1966 and had reached over 150,000 tons a year by 1970. These are examples; a complete list of increased foreign fisheries would include many more.

The result of these increases since about 1960 is that the U.S. commercial catch is now only about 35% of the total commercial catch taken in waters close to our shores (Table 4).

Decline of Haddock

In a few cases, these increased foreign fisheries close to U.S. shores have had adverse affects on U.S. fisheries. Probably the most striking example is the Georges Bank haddock. U.S. catches averaged just over 40,000 metric tons a year in 1955-60. When foreign catches rose briefly in 1965--66 to over 80,000 tons a year, the stocks were badly depleted, and U.S. catches in 1969-70 averaged less than 13,000 tons a year.

However, the cases where foreign fisheries compete directly with U.S. fisheries and can be held directly responsible for their problems are considerably fewer than asserted in the popular press. Compare the examples of increased foreign fisheries

mentioned on preceding page with U.S. commercial landings of the same species in 1960 and 1971:

Species	U.S. catch 1960	1971	Foreign catch
	Thousand metric tons		
Alaska pollock	negligible		2,500 (1969)
Atlantic herring	70	34	700 (1969)
Pacific ocean perch and rockfish	16	16	450 (1965)
Red hake	4	1	100 (1965)
Pacific hake	$<.5$	5	>150 (1970)

In three cases, the U.S. catch has remained stable or increased in spite of large foreign catches. The decrease in U.S. catch of Atlantic herring can be interpreted as the continuation of a trend that began before the foreign fisheries did--peak catches occurred in the late 1940s. The decline in U.S. catch of red hake may have been related to large foreign catches, but the magnitude of the foreign catch demonstrates that the U.S. fleet was not close to fully exploiting the resource.

Foreign Catches Reveal Resources

Discussion of foreign catches close to the U.S. often generates more heat than light. A neglected major effect of the greatly increased foreign catches off the U.S. in recent years is that they revealed in many cases

Table 2 - U.S. supply of industrial fishery products, 1959-71.

Year	From domestic sources	Imported	Total
	- - - (thousand metric tons, round fresh) - -		
1959	1,249	652	1,901
1960	1,108	687	1,795
1961	1,223	1,151	2,374
1962	1,276	1,333	2,609
1963	1,039	1,968	3,007
1964	927	2,319	3,246
1965	993	1,443	2,436
1966	813	2,378	3,191
1967	765	3,381	4,146
1968	825	4,530	5,355
1969	928	1,885	2,813
1970	1,090	1,307	2,397
1971	1,165	1,453	2,618

All 1971 data are preliminary.

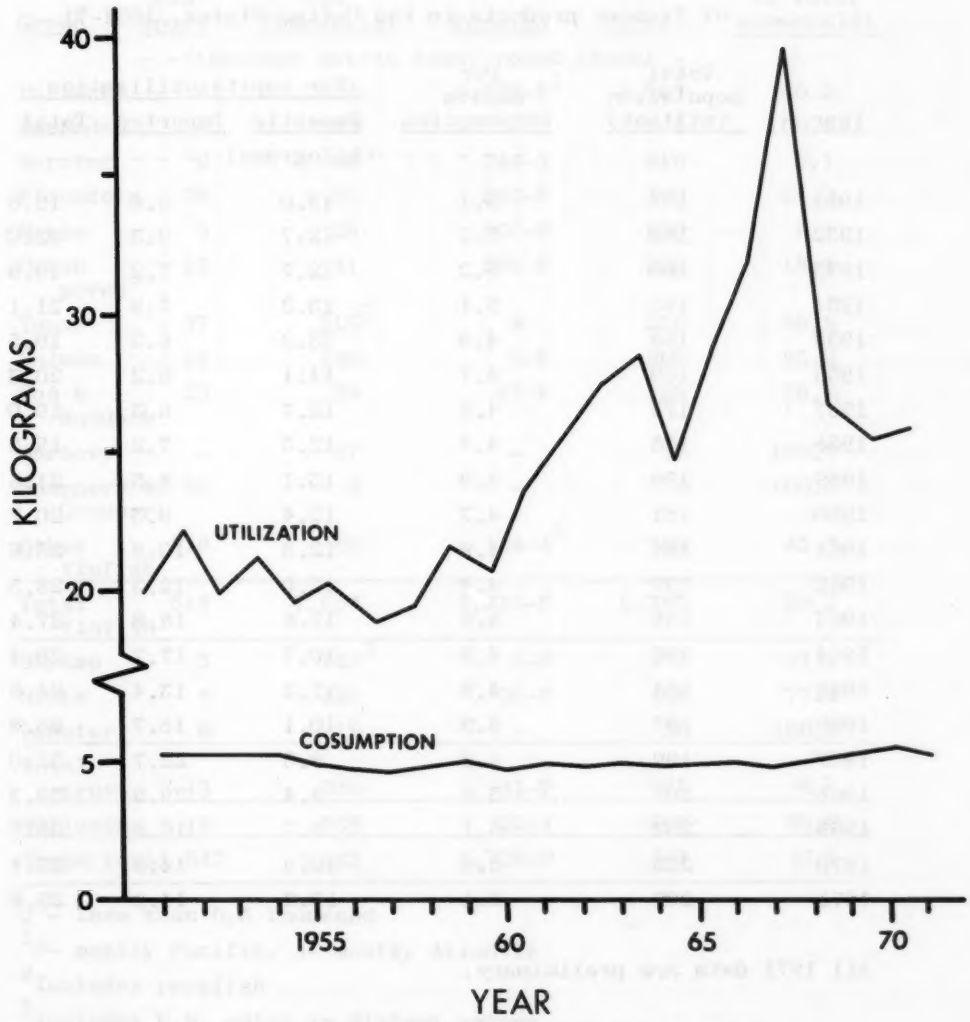

Fig. 2 - Per capita consumption and utilization of fishery products in the U.S., 1951-71.

Table 3 - Per capita consumption and per capita utilization of fishery products in the United States, 1951-71.

Year	Total population (million)	Per capita consumption	Per capita utilization		
			Domestic	Imported	Total
		(kilograms)			
1951	155	5.1	13.0	6.8	19.8
1952	158	5.1	12.7	9.3	22.0
1953	160	5.2	12.7	7.2	19.9
1954	163	5.1	13.2	7.9	21.1
1955	166	4.8	13.2	6.3	19.5
1956	169	4.7	14.1	6.2	20.3
1957	172	4.6	12.7	6.3	19.0
1958	175	4.8	12.3	7.2	19.5
1959	178	4.9	13.1	8.5	21.6
1960	181	4.7	12.4	8.3	20.7
1961	184	4.9	12.8	10.8	23.6
1962	187	4.8	13.0	12.3	25.3
1963	189	4.9	11.6	15.8	27.4
1964	192	4.8	10.7	17.7	28.4
1965	194	4.9	11.2	13.4	24.6
1966	197	4.9	10.1	18.7	28.8
1967	199	4.8	9.3	22.7	32.0
1968	201	5.0	9.4	29.9	39.3
1969	203	5.1	9.7	16.8	26.5
1970	205	5.4	10.9	14.5	25.4
1971	207	5.1	10.9	14.9	25.8

All 1971 data are preliminary.

Table 4 - Landings in 1970 of marine species from waters close to the U.S.

Group	USA Sport	USA Commercial	Foreign	Total	USA commercial as percent of total commercial
	- - (thousand metric tons, round fresh) -				
Pollocks	4	4	2,555-P[1]	2,563	0.2
Menhaden	-	823	-	823	100.0
Herring	Ø	66	744-A	810	8.1
Flounders	39	81	250-P	370	24.2
Hakes	3	26	260-P	289	9.1
Ocean perch[2]	13	41	226-P	280	15.4
Tunas	37	213[3]	Ø	250	99.9
Salmon	11	180	9-P	200	95.2
Cod & Haddock	23	39	67-P	129	36.8
Anchovy	-	87	-	87	100.0
Snappers & Groupers	66	8	-	74	100.0
Other finfish	318[4]	86	104-A[5]	508	45.3
Total finfish	514	1,654	4,215-P	6,383	28.2
Shrimp	5	189[3]	5-P	199	97.4
Crabs	8	122	36-P	166	77.2
Lobster	Ø	19	-	20	100.0
Total crust.	13	330	41-P	385	88.7
Molluscs	19	559	22-A	600	96.2
Grand total	547	2,543	4,728-P	7,368	37.3

Ø - less than 0.5 thousand

[1]P- mostly Pacific, A- mostly Atlantic

[2]Includes rockfish

[3]Includes U.S. catch in distant waters

[4]Over 70% mackerels, sea trouts, croakers, and bluefish

[5]Nearly 80% mackerels and halibut

Table 5 - Values in 1970 of marine species from waters close to the U.S. ("Value" is ex-vessel price.)

Group	USA Sport	USA Commercial	Foreign	Total	USA commercial as percent of total commercial
	(millions of dollars)				
Pollocks	1	1	448	450	0.2
Menhaden	-	32	-	32	100.0
Herring	Ø	2	26	29	7.1
Flounders	13	28	85	126	24.8
Hakes	1	4	29	34	12.1
Ocean perch	1	4	20	25	16.7
Tunas	15	89	Ø	104	99.9
Salmon	6	90	5	101	94.7
Cod & Haddock	8	12	17	37	41.4
Anchovy	-	2	-	2	100.0
Snappers & Groupers	45	5	-	50	100.0
Other finfish	98	24	21	143	53.3
Total finfish	189	293	651	1,133	31.0
Shrimp	3	158	3	164	98.1
Crabs	2	37	11	50	77.1
Lobster	1	39	-	40	100.0
Total crust.	6	234	14	254	94.4
Molluscs	3	64	6	73	91.4
Grand total	198	591	671	1,460	46.8

Ø - less than 0.5 million

See footnotes, Table 4

Note: Values of sport and foreign catches estimated on the basis of U.S. ex-vessel commercial prices.

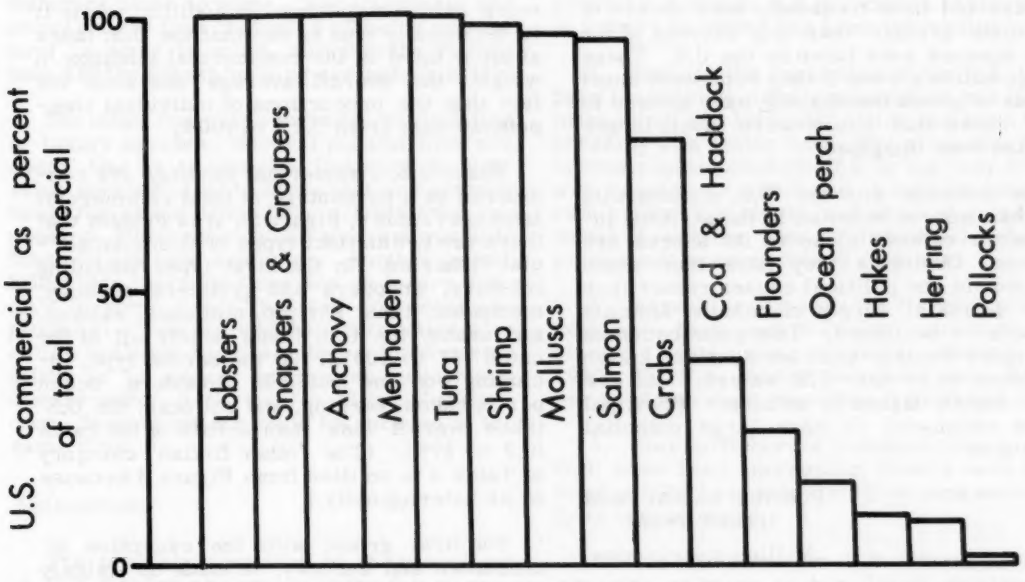

Fig. 3 - U.S. commercial catch as percentage of total commercial catch of various groups in waters close to the U.S.

Table 6 - U.S. imports of edible fishery products (product weights as imported).

Item	1964-68 avg.	1969	1970
	(thousand metric tons)		
Fish fillets	178	248	270
Tuna	194	213	234
Shrimp	79	88	99
Lobster	26	30	26
Sardines	23	21	21
Halibut	9	9	8
Scallops	7	6	8
Oysters	5	8	6
Crabmeat	2	1	1
Other	158	150	163
Total	681	774	836

the presence of unsuspected resources. Foreign catches have frequently been orders of magnitude greater than any catches of the same species ever taken by the U.S. These foreign catches, even if they represent short periods of gross overfishing, have showed in many cases that stocks were much larger than had been imagined.

The reasons why the U.S. commercial fleet has not participated in the striking increase in catches close to its shores are complex. Obviously they have their roots in economic and political causes rather than in the potential supply of marine animals available to be fished. This point becomes even more evident when we consider known resources in or near U.S. waters which are as yet lightly fished or unfished. Principal groups estimated to have large potential yields are:

	Possible annual yield (round fresh)
	Million metric tons
California anchovy	1.8
Calico scallop	.5
Ocean quahog	.5
Gulf of Mexico clupeids	.3
Atlantic mussels	.1
Total	3.2

If we accept the 6.8 million metric tons now taken commercially from waters close to the U.S. (Table 4) as a reasonable estimate of sustainable annual yield from those species now exploited, and add the 3.2 million tons that could be taken from relatively unexploited resources, the total potential catch in waters near the U.S. is 10.0 million tons a year. The present catch by the U.S. fleet is about a quarter of this amount.

U.S. Landings: 1/3 Weight, 1/2 Value

The reason for the difference between the potential and the actual catch of the U.S. fisheries may be seen in the nature of our commercial fisheries and in the nature of our imports. A crude evaluation of the U.S. catch may be made by comparing volume and value (Tables 4 and 5). While the U.S. fleet takes only about a third of the total commercial landings in weight from waters near the U.S., it takes nearly half the total value. U.S. commercial fisheries are biased toward the more valuable species. In addition, while it is technically true to say that the U.S. takes about a third of the commercial landings in weight, the overall average obscures the fact that the proportions of individual components vary from 0.2% to 100%.

When U.S. commercial landings are considered as a percentage of total commercial landings (Table 4, Figure 3), it is evident that there are two distinct types of U.S. commercial fisheries. In the first type, including lobsters, snappers and groupers, anchovy, menhaden, tuna, shrimp, molluscs, salmon, and crabs, the U.S. takes nearly all of the catch (77 to 100%). In the second type, including cod and haddock, flounders, ocean perch, hakes, herring, and pollocks, the U.S. takes overall less than a fifth of the catch (0.2 to 37%). (The "other finfish" category of Table 4 is omitted from Figure 3 because of its heterogeneity.)

The first group, with the exception of menhaden and anchovy, is made up entirely of species with high value per unit weight--"luxury" seafoods. The second group is almost entirely composed of species of low or medium value per unit weight.

Most Fishermen Stay Close

U.S. fisheries tend to operate close to home. Recently it was estimated that about 40% of the U.S. commercial catch is made within 3 miles of shore and about 80% within 12 miles. The fisheries also concentrate on high-priced products. The most important exceptions are the menhaden fishery, which exploits a very high volume of low-priced fish that can be caught close to home, and two distant-water fisheries for high-priced tuna and shrimp.

Our principal imports are low-priced fish meal, medium-priced fish fillets, and enough luxury products (tuna, shrimp, lobster) to satisfy the domestic demand not filled by our own fisheries (Table 6).

Limited Options for U.S. Fisheries

If U.S. commercial fisheries are to expand in the next few years in the face of present economic realities (assuming that these do not change), the number of options open to them seem limited. One route would

be to exploit new low-priced but high-volume fisheries close to home. The California anchovy and the Gulf of Mexico clupeids are the first to come to mind, although the Pacific hake and the Alaska herring are possibilities.

The other route is to increase exploitation of luxury species. Several possibilities are open: One is to increase fisheries on high-value species close to home that are already being fished but which have potential for expansion. Blue crabs, surf clams, and possibly lobsters are good examples. Another possibility is to increase fisheries on luxury species in home water that are now being exploited at a rate far less than their potential--calico scallops, for example. A third possibility is to expand present or initiate new distant-water fisheries for high-value species. Several options could be pursued at the same time.

Aquaculture

The possible contribution of aquaculture to U.S. fishery production in the future cannot be neglected, but neither should aquaculture be viewed as a panacea. Present commercial production is mainly a very few thousand tons of freshwater catfish annually, but technical expertise for raising many species exists or is being developed. Constraints are primarily economic: it is necessary not only to raise the animals but to sell them at a profit. It is likely that production for many years to come will be concentrated heavily in the highest-priced items. Thus it will probably be a matter of decades at least before any substantial part of the 5 kilograms consumed annually by each U.S. inhabitant will be produced by aquaculture. It will be longer still (if ever) before aquaculture makes any contribution to the 20 or more kilograms of industrial fishery products utilized per capita.

U.S FISHERIES & THEIR POTENTIAL

It is possible at this point to summarize the principal facts about U.S. fisheries and their potential:

1. Domestic production of fishery products has been stable for many years.

2. Per-capita consumption of fishery products is stable, but per-capita utilization of fishery products has been increasing.

3. Because the population of the U.S. has been increasing, total consumption has been increasing, and total utilization has been increasing at a faster rate. The projected 300 million population of the U.S. in the year 2000 will require an additional .5 million tons of edible fishery products, and at least an additional 2 million tons of industrial fishery products if present trends continue.

4. Increasing demands for fishery products have been met in recent years by constantly increasing imports. During the 1960s, the U.S. started to import more fishery products each year than it produces.

5. Foreign fisheries in waters close to the U.S. have been increasing, from a very low level in 1960 to nearly 5 million tons annually in recent years.

6. The reasons for U.S. fisheries decreasing relative to population are more closely related to economics and politics than they are to the presence of fishable populations of marine animals in nearby waters.

7. U.S. fisheries are selective, concentrating heavily on high-priced and high-volume species in easily accessible waters.

8. Options open for expansion of U.S. fisheries in the near future seem limited to three: to exploit new low-priced high-volume fisheries in home waters, to increase catches of high-priced species in home waters, or to establish new distant-water fisheries for high-priced species.

9. Substantial contributions by aquaculture to U.S. fishery supplies still lie some time in the future. When they do come, they will probably satisfy only a small part of the demand for fishery products.

(Most of the statistical information in this report was taken from "Fisheries of the United States, 1971"--NMFS Current Fishery Statistics No. 5900, and from "The United States Marine Fishery Resource, 1971"--in press as an NMFS Circular.)

THE ATLANTIC COAST SURF CLAM FISHERY 1965-69

John W. Ropes

This is a summary of the very active Atlantic coast surf clam (Spisula solidissima) fishery for 1965-69. Landings each year during the 5-year period were progressively larger and set new catch records. This one species has supplied more than half the clam meats in the United States. Landings averaged 44.7 million pounds annually and peaked at 49.9 million pounds in 1969.

During the 5-year period, the most significant events were increased effort, decline in surf clam stocks off Point Pleasant, New Jersey, one of the principal ports for landings, and movement of vessels to more southern ports. Effort was directed to clam stocks off Delmarva (Delaware, Maryland, Virginia) Peninsula. These stocks were important in sustaining a high annual production of clam meats. It is predicted that landings from these stocks will increase in the near future.

Surf clams (Spisula solidissima) supplied better than half the meats for clam products in the United States during 1960-69. Landings increased in the second half of the decade (Fig. 1). The importance of the fishery was recognized by the Bureau of Commercial Fisheries early in the 1960s. Research was initiated on the biology and population dynamics of the clam in 1963 (Merrill and Webster, 1964). As part of the research program, vessel captains in the surf clam fleet were interviewed frequently to obtain information on fishing location, effort, and catch. Data from these interviews have resulted in five annual reports on the fishery (Groutage and Barker, 1967a and b; Yancey, 1968 and 1970; Barker and Ropes, 1971). The reports give a detailed account of the fishery for 1965-69. The following summarizes the data for the same 5-year period.

THE RESOURCE & THE FISHERY

Surf clams are commercially abundant from Montauk Point, Long Island, New York, to Cape Charles, Virginia. Although they have been found from the surf zone to 420 feet, survey results indicate that they were taken most often at an average depth of 93 feet. Clams at stations deeper than 140 feet were less numerous and smaller (Merrill and Ropes, 1969; Ropes and Merrill, 1969; Ropes, 1971). In 1970, the fishery extended from Long Island to off the mouth of Chesapeake Bay.

VESSELS, GEAR, & PRODUCTIVITY

Most vessels in the surf clam fleet are from other fisheries. More than half were built before 1950, and a few are almost 100 years old (Table 1).

Table 1 - Surf clam fleet age composition

Year built	Percent
1875-1899	6
1900-1924	13
1925-1949	40
1950-1969	41

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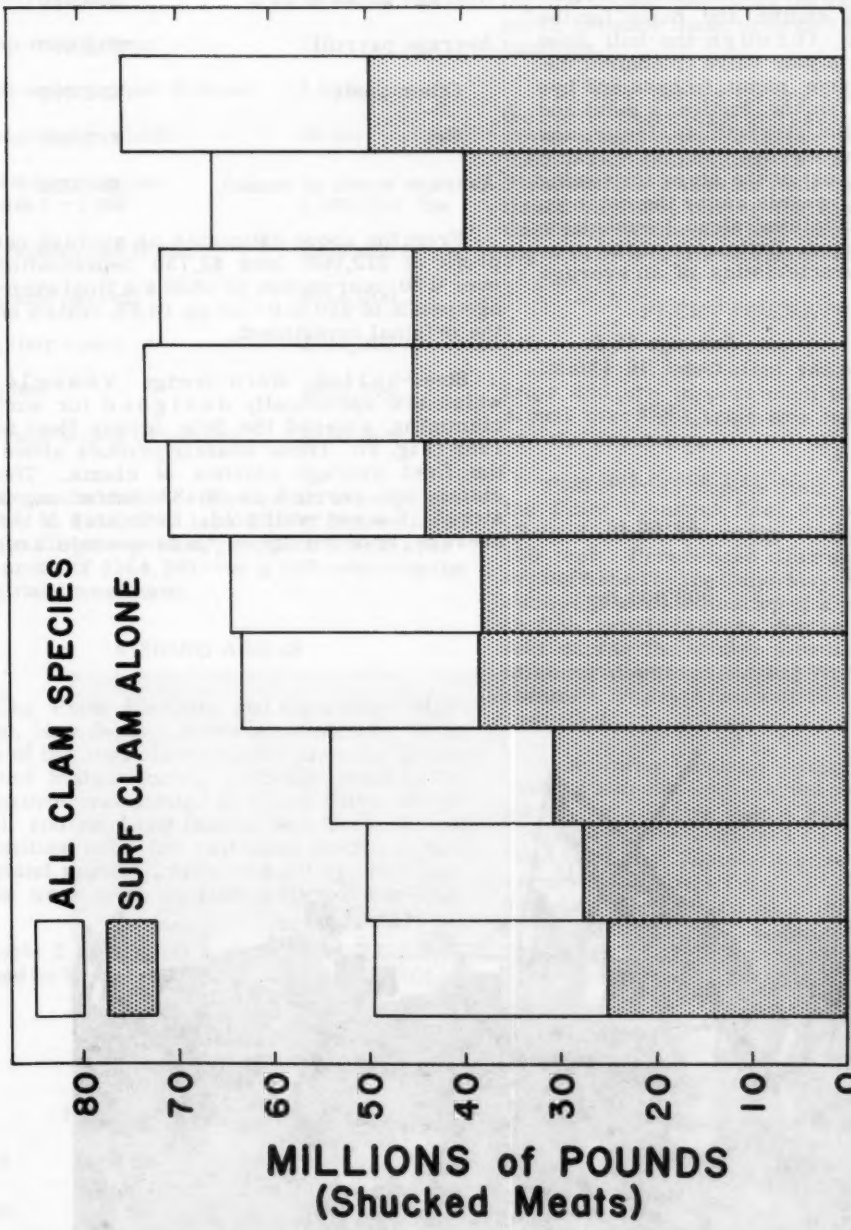

Fig. 1 - The quantities of surf clams and all species of clams landed in the United States, 1960-69.

Vessel modifications to fish for surf clams include a diesel engine and pump for the hydraulic dredge, through-the-hull inlet pipes to the pump, a gate valve to control the water passing from pump to hose and hydraulic manifold on the dredge, a mast and boom of sufficient strength to lower and retrieve the heavy dredge, and an A-frame stanchion or king post at the stern for towing the dredge. Most vessels carry the catch on deck in sacks containing about 1 bushel, or in 30-32 bushel cages. Estimates of the productivity and characteristics of an average vessel are:

Vessel length	Average 68 ft.; range 40-135 ft.
Pump horsepower	226
Pump water output @ 90 psi	1,800-3,600 gpm
Dredge knife width	40-60 in.
Average catch per vessel - 1969	508,000 lbs.
Average gross @ 12 ¢	$60,960
Average payroll	$34,000
Other costs	$14,000
Net	$12,960
Average worth of vessel	$55,000

From the above estimates, an average net profit of $12,960, less $2,750 depreciation over a 20-year period, produces a final average profit of $10,210--or an 18.6% return on the original investment.

Steel-hulled, stern-dredge vessels, which are specifically designed for surf clamming, entered the New Jersey fleet in 1969 (Fig. 2). These vessels produce above the fleet average catches of clams. The clams are carried in 30-32 bushel cages stored in a wet-well hold. Estimates of the average productivity of these vessels are:

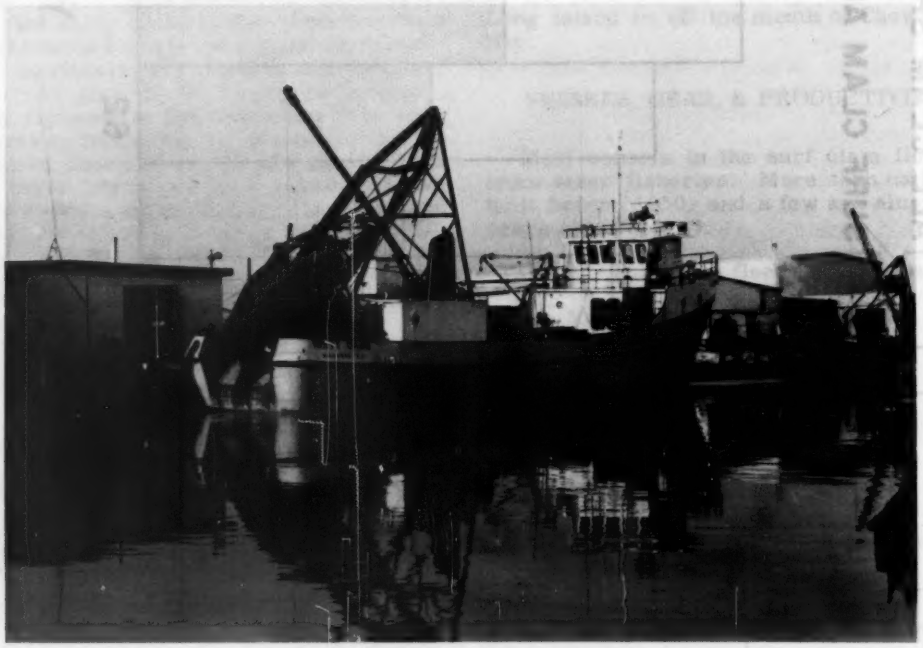

Fig. 2 - A steel-hulled, stern-rigged surf clam vessel.

Vessel length	75-80 ft.
Pump horsepower	370
Pump water output @ 90 psi	3,600 gpm
Dredge knife width	60 in.
Average catch per vessel - 1969	3,000,000 lbs.
Average gross @ 10¢	$300,000
Average payroll	$114,000
Other costs	$ 14,000
Net	$232,000
Average worth of vessel	$150,000

From the above estimates, an average net profit of $172,000, less $7,500 depreciation over a 20-year period, produces a final average profit of $164,500--or a 90% return on the original investment.

FISHING AREAS

The Point Pleasant and Cape May-Wildwood, New Jersey, ports accounted for 78 to 96% of the surf clams landed annually in the United States during 1965-69; most of the remainder was landed at Ocean City, Maryland, and on Long Island, New York. Small quantities used for bait were landed at New England ports. Interviews with vessel captains were most frequent and complete during the 5-year period at the two New Jersey ports because these provided the bulk of the landings.

Table 2 - Estimates of the size of areas fished by New Jersey surf clam fleet, 1965-69

	Square Nautical Miles of Fishing Area	
	Off Point Pleasant	Off Cape May-Wildwood
1965	220	140
1966	330	30
1967	510	470
1968	640	780
1969	780	1,100

The New Jersey fishing areas were near the ports. Significant increases in the size of areas fished have occurred annually since 1965. The area fished in 1969 by the Point Pleasant fleet was more than three times that fished in 1965; during the same period, the Cape May-Wildwood fleet increased its fishing area by a factor of almost eight (Table 2).

FLEET OPERATION

Nearly all surf clam vessels make day-trips and are in port each evening. Occasional overnight trips are made, but these are the exception.

The average depths fished each year by the Point Pleasant fleet were consistent at 73 to 76 feet; the range of depths was 40 to 120 feet. Pronounced fluctuations in the depths fished by the Cape May-Wildwood fleet each year were indicative of a seasonal effort to fish shoal, inshore depths averaging 40 feet during the winter months--and deeper, offshore depths averaging 70 feet during the summer. A depth range of 18 to 120 feet was recorded.

The annual average daily effort by the Point Pleasant fleet varied from 8.8 to 9.8 hours, or no more than 1 hour during the 5-year period; the averages for the Cape May-Wildwood fleet varied from 6.0 to 7.9 hours, or almost 2 hours (Fig. 3). Thus, the Point Pleasant fleet consistently fished more hours per day than the Cape May-Wildwood fleet. Increases in the average daily effort have been greatest in the second half of the 5-year period. There were records of trips as short as 1 hour fishing time, due usually to equipment failure, and as long as 22 hours.

Catch Per Hour

High annual average-catch-per-hour values of 678 and 593 pounds were recorded for the Point Pleasant fleet in 1965 and 1966, but thereafter the values declined to between 391 and 425 pounds (Fig. 3). Even higher catch-per-hour values (about 900 lbs.) were recorded for the Cape May-Wildwood than Point Pleasant fleet during 1965 and 1966. A decline followed in 1967 and 1968 (578 and 476 lbs.) but not to the low values observed for

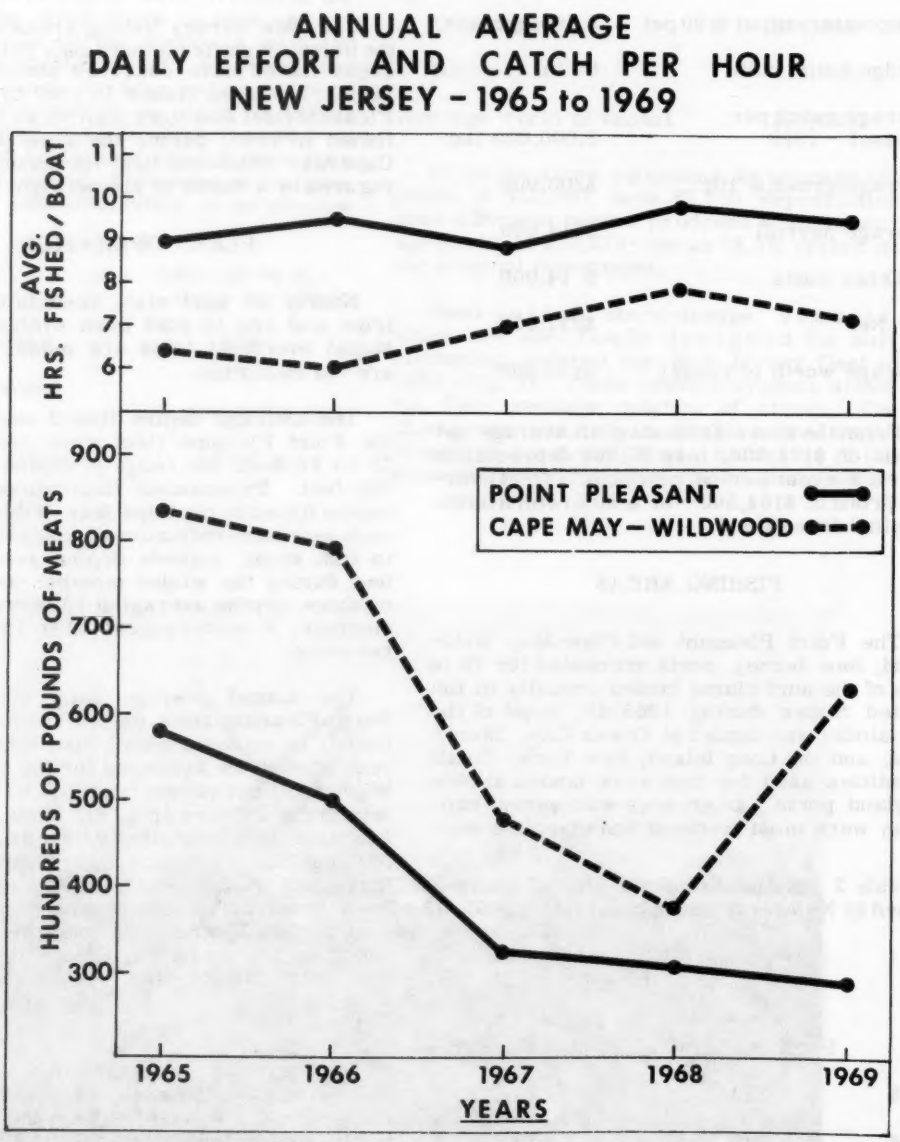

Fig. 3 - The annual average daily effort and catch per hour of surf clams for vessels fishing from Point Pleasant and Cape May-Wildwood, New Jersey, ports in 1965-69.

the Point Pleasant fleet. In 1969, the Cape May-Wildwood fleet catch-per-hour value increased to 731 pounds.

The Point Pleasant fleet consistently caught clams of a larger average shell length each year than the Cape May-Wildwood fleet. The mean annual lengths recorded for clams landed at the former port were 149 to 155 mm. (5.9-6.1 in.); those for the latter port were 130 to 149 mm. (5.1-5.9 in.) (Fig. 4). The largest and smallest clams were taken by the Cape May-Wildwood fleet only in 1968. The largest clam was taken in 1969 by a Point Pleasant vessel. It was 203 mm. (8.0 in.) long. A larger specimen 210 mm. (8.3 in.) long has been reported (Ropes, Chamberlin, and Merrill, 1969).

The Point Pleasant fleet landed 33.5 and 32.4 million pounds of surf clam meats in 1965-66 (Fig. 4). These landings constituted the bulk of the New Jersey catch for those years and were followed by a nearly 10 million pound decline in 1967. In 1968 and 1969, landings 4 to 8 million pounds lower than those recorded for Cape May-Wildwood were observed. The decline in annual landings from 33.5 to 14.0 million pounds at Point Pleasant during the 5-year period was a decrease of 60%, but the number of vessels using the port declined only 30%. Vessels landing surf clams at Cape May-Wildwood contributed to the bulk of the New Jersey catch in 1968-69. A $2\frac{1}{2}$-fold increase in landings from 8.8 to 22.0 million pounds at Cape May-Wildwood during the 5-year period--and 5-fold increase in the number of vessels--helped maintain New Jersey landings that were higher than those for any other state in the Middle Atlantic Bight.

Long Island & Ocean City

Annual landings of surf clams at Long Island and Ocean City ports have increased during the 5-year period (Fig. 5). Although the landings on Long Island have been less than 4 million pounds each year, they have increased almost $2\frac{1}{2}$-fold during the 5-year period--from 1.5 to 3.7 million pounds--and with about a $1\frac{1}{2}$-fold increase in number of vessels. Landings increased most dramatically at Ocean City. Less than 1 million pounds of meats were recorded for 1965 and 1966; only one vessel fished from the port, and most of its catch was used for bait. Since 1966, landings at Ocean City have increase 7-fold, and the numbers of vessels 13-fold.

TRENDS AND PREDICTIONS

Long Island Fishery

A small fleet fishes on nearshore beds of clams off the western half of the Long Island oceanside coast. Although surf clams were found along the whole coast of Long Island during a survey of the Middle Atlantic Bight, the area was rated next to lowest in abundance of the four surveyed (Ropes, 1971). The clams also inhabited the shoalest depths. Beds off the eastern half of Long Island are not fished because the vessels have difficulties navigating channels to nearby ports. These factors, then, limit the Long Island fishery. An expansion of effort may result in overfishing the available stocks.

Point Pleasant Fishery

After record high landings in 1965 and 1966 at the Point Pleasant port (Fig. 4), the fleet size was reduced because the catch rate declined in 1966 and continued to decline thereafter (Fig. 3). The reduction in effort on the beds off Point Pleasant was recommended to the Sea Clam Packers Committee, Oyster Institute of North America, at a June 1967 meeting by the Bureau of Commercial Fisheries surf clam program staff. The recommendation was made because the results of research surveys and interview data indicated that the available stocks had been reduced and that more effort would merely distribute the catch among more vessels. Vessels moved to the Cape May-Wildwood and Ocean City ports in 1967 and continued to do so thereafter. The vessels at Point Pleasant have maintained a fairly steady average catch rate since 1966 of about 400 pounds of meats per hour.

The Point Pleasant beds have been of major importance to the industry since 1950. Predictions of how soon fishing may be increased on the beds cannot be exact. But less effort in the area means that less bottom is being disturbed by hydraulic dredges, and this may enhance clam survival. The natural reproduction of a residual population throughout the area may repopulate the seabed with young clams. Surf clams spawned twice each year during 3 of 4 years that detailed observations were made (Ropes, 1968). Thus, larvae are probably produced each year. The fate of the larvae and set of young clams in the natural environment are unknown, but recruits to the fishery stocks were estimated

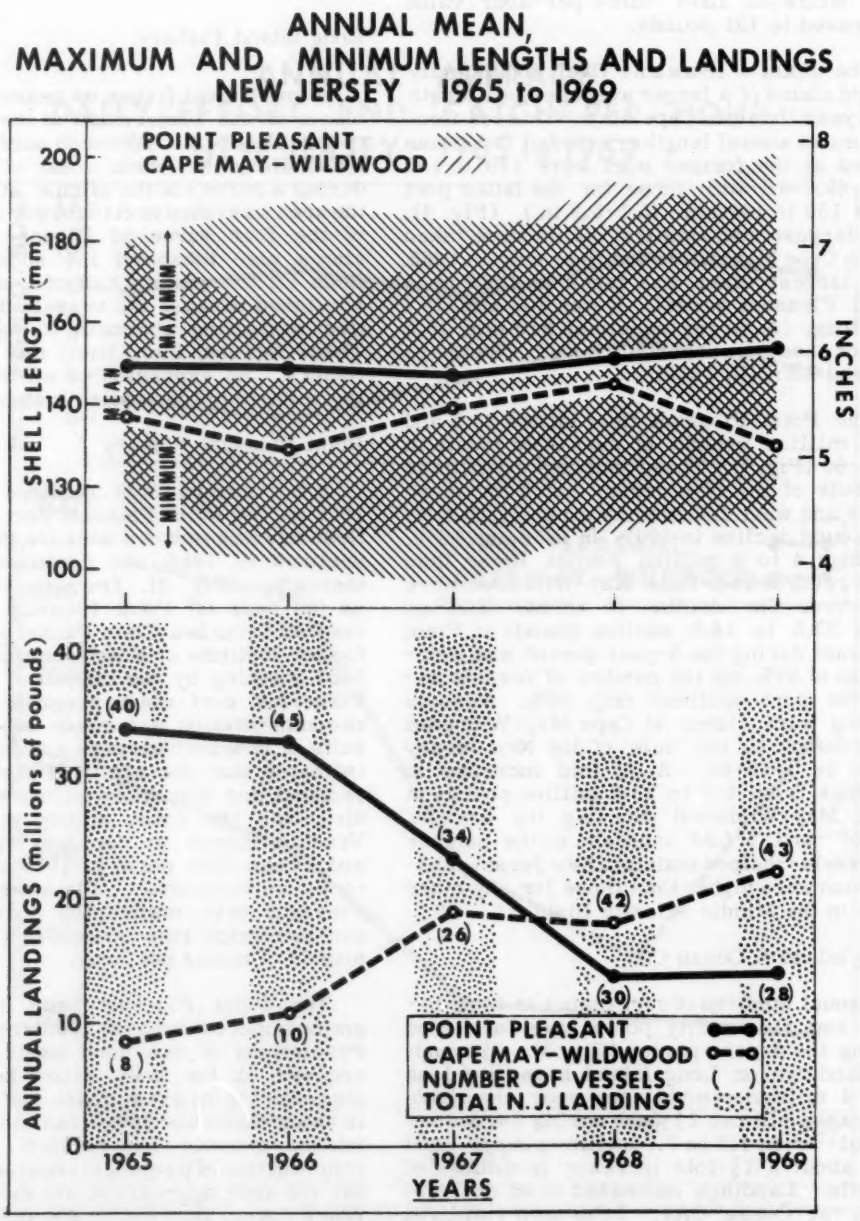

Fig. 4 - The annual maximum mean and minimum shell lengths of surf clams, millions of pounds of meats landed, and number of vessels fishing for the Point Pleasant and Cape May-Wildwood, New Jersey, ports in 1965-69.

to be 5 to 6 years old (Ropes, Chamberlin, and Merrill, 1969). A 1970 set would be expected to reach minimum commercial size by about 1975. An additional 5 years of growth would probably produce clams of the shell lengths being harvested now.

Cape May-Wildwood Fishery

The low effort and production of the Cape May-Wildwood fleet in 1965-66 increased markedly thereafter because vessels were transferred from the Point Pleasant port, and vessels were added to the fishery (Figs. 3, 4). This action increased the landings in 1968-69 to quantities greater than those for Point Pleasant. High hourly catch rates in 1965-66 by the Cape May-Wildwood fleet decreased significantly in 1967-68 (Fig. 3). In the first 2 years, the fleet concentrated on dense beds of small clams nearshore; in the latter 2 years, effort was directed more to offshore beds of large clams. The industry prefers the larger offshore clams because of their greater meat yield (Barker and Merrill, 1967), but the small inshore clams are usually fished when weather prevents offshore operations. A lower catch rate of clams offshore caused the fishermen to range over a greater area in an attempt to locate the best concentrations (Table 2). An analysis of small (less than 140 mm. long) and larger (more than 139 mm. long) clams during 1967-69 distinguishes between the catch from inshore and offshore beds (Table 3). In 1969, two new stern dredge vessels of unique design entered the fishery. Their effort increased the catch-per-hour average and total landings at Cape May-Wildwood, but they concentrated on inshore beds of small clams and accounted for almost half the landings from this source.

Table 3 - Landings from inshore and offshore surf clam stocks by Cape May-Wildwood fleet, 1967-69

	Million of Pounds and (Percent) Landed		
	Inshore stocks	Offshore stocks	Total
1967	12.9 (69)	5.8 (31)	18.7
1968	6.3 (35)	11.7 (65)	18.0
1969	14.0 (64)	8.0 (36)	22.0

In the future, landings at Cape May-Wildwood will increase slightly above those for 1969. Some of the fleet has explored the beds off Delaware, and the more available stocks in beds nearer to port are being fished.

Ocean City Fishery

Ocean City has been used for landings of surf clams since 1952, but the quantities never exceeded 2.5 million pounds until after 1967; the 64,000 pounds landed in 1966 were nearly the lowest amount recorded (Fig. 5). Vessels were transferred to the port from more northern ones in New Jersey after 1966, and landings increased dramatically to 7.1 million pounds in 1969. The increase in landings was expected. Survey results located new beds of surf clams off the Delmarva Peninsula coast that contained nearly the same quantities as those off New Jersey (Merrill and Ropes, 1969; Ropes and Merrill, 1969; Ropes, 1971). These results were reported to the fishermen (Ropes, 1970) and at meetings attended by industry representatives. Even greater landings are expected at this port in the next few years, although dock facilities limit the entry of vessels.

GENERAL COMMENTS

Average annual landings of 44.7 million pounds of surf clam meats during the second half of 1960-69 were significantly greater than the 32.0-million-pound annual average for the first half; landings of 49.6 million pounds in 1969 were the highest ever reported (Fig. 1). New vessels entered the fishery during 1965-69 and increased size of surf clam fleet by 69%. However, this additional effort produced only 40% more clams, based on the above averages. The greater expenditure of effort and lower production of clams were caused by a decline in catch rate on beds off Point Pleasant, the generally lower catch rate on offshore beds, and the lower yield of small clams from nearshore beds. A movement of vessels to Cape May-Wildwood and Ocean City ports has focused effort on beds of clams off Delmarva Peninsula that, heretofore, had not been fished. An increase in effort on these beds is expected to produce future landings greater than those for 1969. Some vessels are expected to use ports south of Ocean City in the near future.

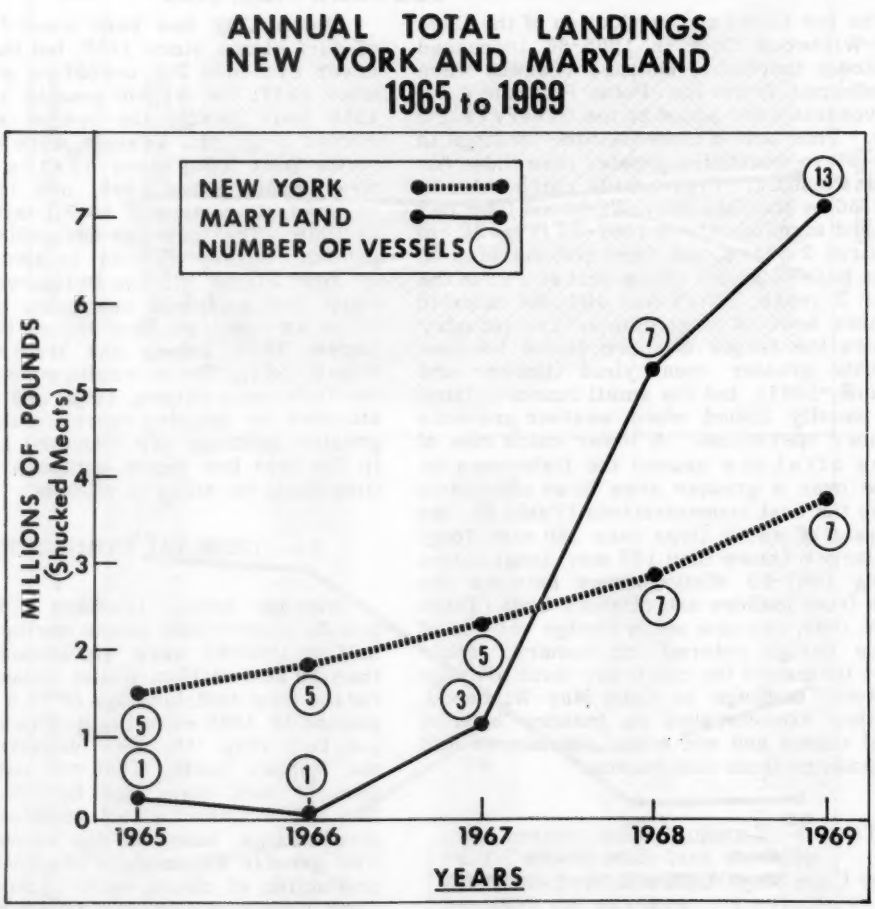

Fig. 5 - The annual total landings of surf clams and number of vessels at New York and Maryland ports in 1965-69.

Technological Advances

Several technological advances have been made or are in progress to harvest and process surf clams. The stern dredge vessels designed specifically for surf clamming are more efficient than traditional vessels. Vessels able to catch and shuck clams at sea are being developed. These will fish 24 hours a day, hold the meats under refrigeration, and remain at sea for several days rather than operate on a day-trip schedule. Machines now in use have been patented to open the clams (Snow, 1971). These replace hand labor at shore-based plants, and modifications may sometime adapt these for use at sea. Research on microwave ovens to open the clams is in progress. Surf clam meats are manually cleaned of the gonad, digestive gland, and stomach before further processing of the edible muscle tissues. A "mollusk flesh processor" has been patented to replace hand labor (Marvin and Henderson, 1969). These advances are a characteristic of the dynamic fishery.

Ocean Quahogs

Ocean quahogs, Arctica islandica, are frequently taken in bottom samples off the east coast of the United States (Merrill and Ropes, 1969). They have occurred in abundance during surveys for surf clams off Long Island, New York, and New Jersey (Ropes, 1971). Relatively small quantities of this clam have been utilized since 1945. The potential of the ocean quahog resource has not been realized because of technological problems in processing the clam and greater availability of surf clams in the past two decades.

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PREDATION BY BLUEFISH ON FLATFISHES

Fred E. Lux and John V. Mahoney

Severe wounds observed on yellowtail flounder, Limanda ferruginea (Storer), from otter trawl catches off New York in 1971 apparently were inflicted by bluefish. Some of the yellowtail probably survive the wounds, in which large pieces of flesh are sometimes bitten away. Such healed wounds possibly are related to certain kinds of morphological anomalies occasionally found in flatfishes.

Bluefish, Pomatomus saltatrix (L.), which occur in New England and Middle Atlantic coastal waters in summer and autumn, are probably the most voracious of Atlantic coast fishes. Their prey consists of both pelagic and demersal fish and also, at times, invertebrates (Baird, 1873; Bigelow and Schroeder, 1953). There are, however, no published accounts of bluefish predation on adult flatfishes (Pleuronectiformes), which live in closer association with the bottom than most other demersal fishes, although baby winter flounder, Pseudopleuronectes americanus (Walb.), have been observed in stomachs of juvenile bluefish (Greeley, 1939).

We report here cases of predation on adult yellowtail flounder, Limanda ferruginea (Storer), in the autumn of 1971. We discuss the possibility that some of the morphological anomalies occasionally found in coastal flatfishes stem from wounds inflicted by bluefish.

Five Bitten Yellowtail

On September 28, 1971, Captain Norman Edwards, a commercial otter trawl fisherman from Amagansett, New York, brought to us five yellowtail flounder that he had caught the day before off Montauk Point, Long Island (40°51' N, 71°42' W) at a depth of 30 fathoms (55 meters). All five, which ranged in total length from 31 to 36 centimeters, clearly had been bitten on posterior parts of their bodies (Figure 1). In four of the five, substantial parts were bitten away. The fish apparently were alive when caught because all were in fresh condition. The wounds of two were healing (Figure 1a and 1b). This indicates that some of the yellowtail survive wounds of this severity. The survival of other species of fish after suffering wounds at least as severe as these has been reported (Breder, 1953; Gunter and Ward, 1961).

The Captain's Testimony

Captain Edwards was fishing for yellowtail flounder and other mixed fishes in the above area through the summer and autumn of 1971. He felt that the wounded yellowtail had been attacked by bluefish which, he said, had been unusually common in this area since mid-August and sometimes drove other fish from the grounds. Occasionally in this period he was catching one- or two-dozen bitten yellowtail per haul. He estimated that the average haul contained a total of about 1,000 to 2,000 yellowtail. Sometimes he caught one or two bluefish in a haul; individuals ran about 5 to 10 pounds (2.3 to 4.5 kilograms). He did not examine any of their stomach contents prior to November.

On November 9, 1971, Captain Edwards caught a bluefish in the area referred to earlier. He gave it to us along with its stomach contents. This fish, 52 centimeters fork length and 1.9 kilograms gutted weight, had in its stomach 340 grams of fish chunks consisting of six pieces of yellowtail and two pieces of northern sea robin, Prionotus carolinus (L.), (Figure 2). The prey apparently had been eaten not long before the fish was caught, for only first signs of digestion were

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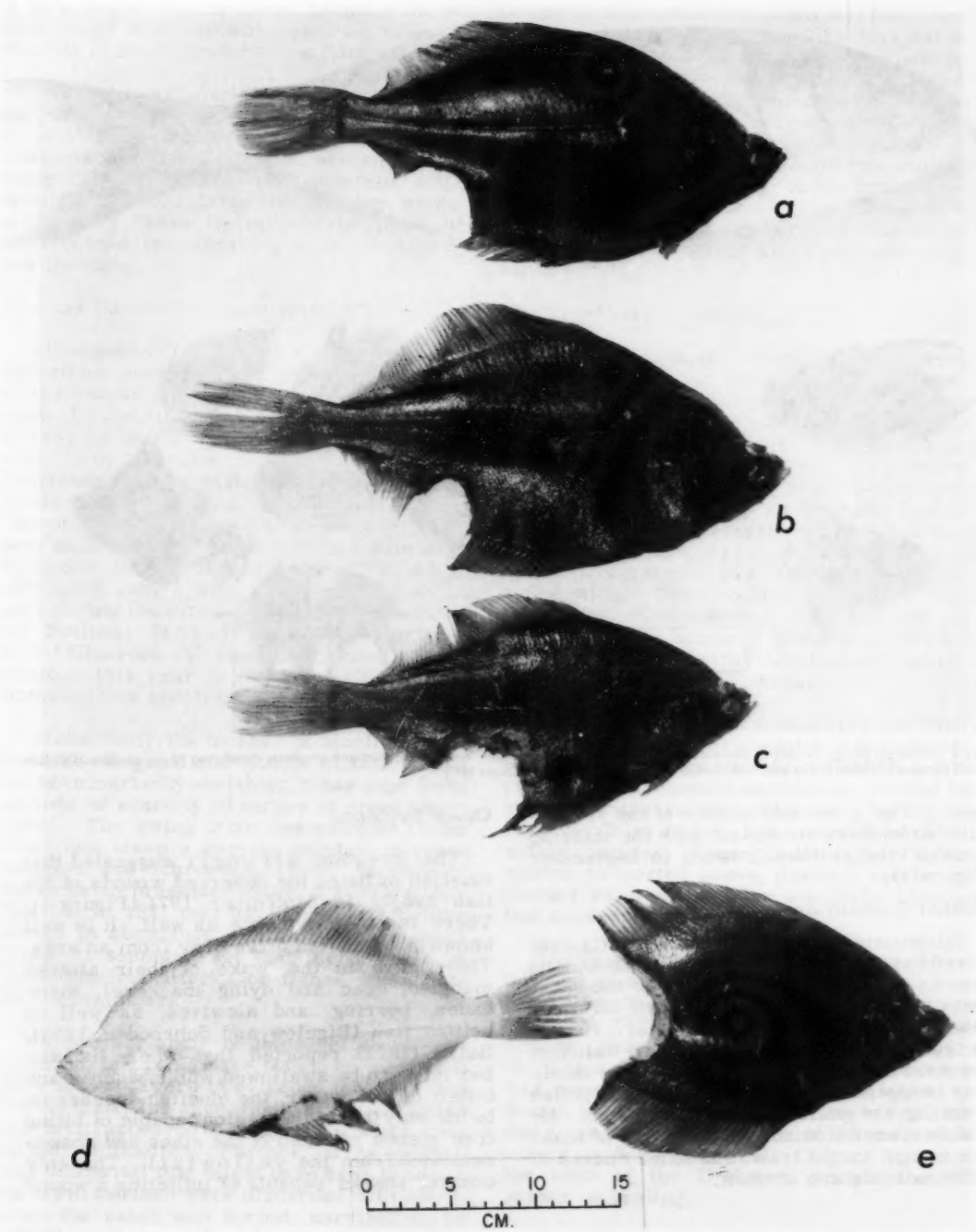

Fig. 1 - Yellowtail flounder, caught in September 1971 off Long Island, New York, with wounds apparently inflicted by bluefish.

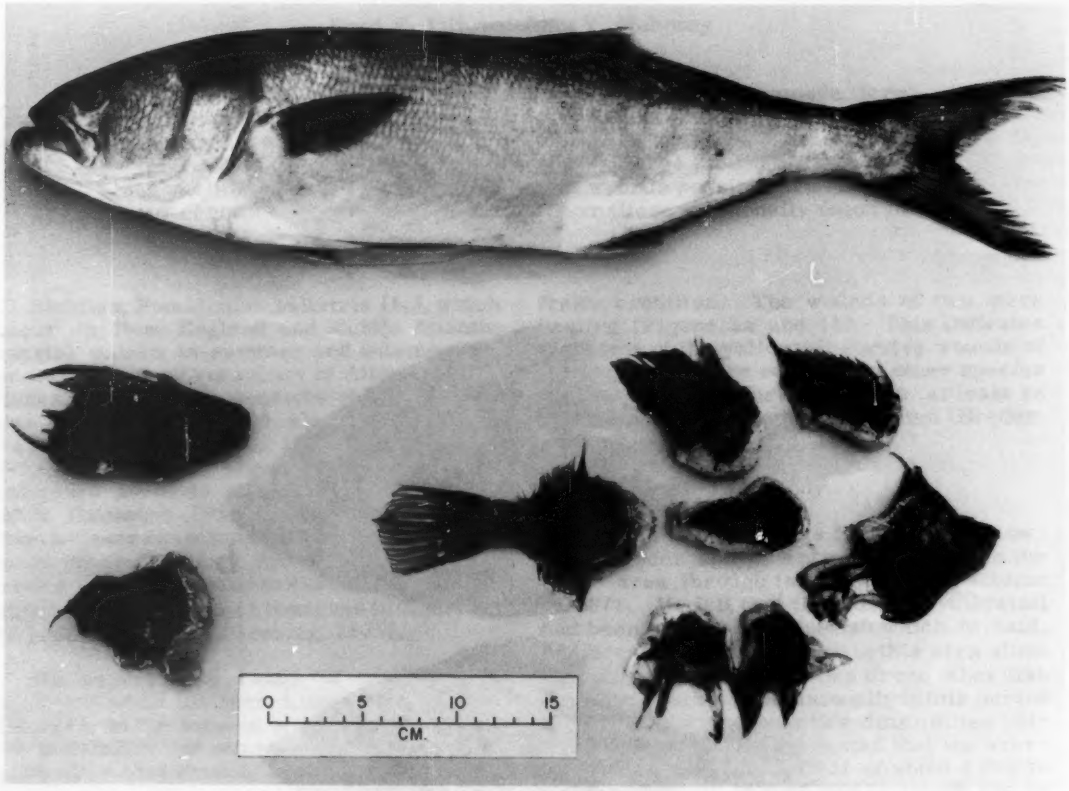

Fig. 2 - Bluefish (top), caught in November 1971 off Long Island, New York, with stomach contents consisting of six chunks of yellowtail flounder (lower right) and two chunks of northern searobin (lower left).

noted. The sizes and shapes of the yellowtail chunks were consistent with the missing parts of the yellowtail taken in September (Figure 1).

Another Captain Agrees

Subsequently, we talked with Captain Alfred Rebello of New Bedford, Massachusetts who, in 1971, had fished some of the same areas off Long Island that Captain Edwards fished. His experience was similar. He reported that catches of yellowtail dwindled whenever bitten fish appeared in the catch. This suggested to him, also, that bluefish broke up the yellowtail concentrations. He said he opened stomachs of a number of bluefish caught in the trawl and found chunks of yellowtail in some of them.

Other Evidence

The foregoing strongly suggested that bluefish inflicted the observed wounds of the fish caught in September 1971 (Figure 1). There is other evidence as well. It is well known that bluefish drive prey from an area. They leave in the wake of their attacks mangled, dead and dying mackerel, menhaden, herring, and alewives, as well as bottom fish (Bigelow and Schroeder, 1953). Baird (1873) reported that where fish are too large to be swallowed whole, chunks are bitten off. Further, the bluefish appears to be the only fish of the region capable of biting free pieces of flesh of the sizes and shapes removed from the yellowtail. The only coastal sharks capable of inflicting a wound

of this shape are too large to make one of such small size. In any case, we have no records of shark predation on flatfishes.

The yellowtail wounds corresponded with the jaw shape and size and dentition of about 2- or 3-kilogram bluefish. The sharp-edged, triangular teeth of bluefish are similar to those of some sharks. The bluefish, after seizing prey too large to swallow whole, presumably flexes its body vigorously, and so develops the shearing action needed to bite through.

Bluefish Unusually Common in 1971

All reports from sport and commercial fishermen corroborated the views of Captains Edwards and Rebello that bluefish were unusually common in the summer and autumn of 1971 in the New York and New England area. For example, the National Marine Fisheries Service statistics reporter from Rhode Island reported for September 1971: "No one that I have talked to has ever seen seen such a profusion of bluefish, for so long, in Rhode Island waters before." Bluefish also were caught with greater frequency in 1971 during the autumn otter-trawl survey of the National Marine Fisheries Service R/V 'Albatross IV' than in previous years, although this gear is not very efficient for sampling this species.

Historically, the number of bluefish found in the New England and Middle Atlantic areas has been markedly variable. It has gone from periods of scarcity to surges of great abundance. The swing from one extreme to the other has taken a varying number of years (Bigelow and Schroeder, 1953). In view of the evidence presented above, it appears that bluefish in 1971 may have been approaching a high in abundance. With the higher abundance, it seems likely that there would be more bluefish attacks on fishes other than their usual prey.

Of course, some of the bluefish attacks on yellowtail could have occurred within the otter trawl. There is evidence that this was not normally the case, however, since bitten yellowtail appeared in many hauls which contained no bluefish. Further, it is unlikely that yellowtail that might have been bitten in the trawl and then were discarded overboard, when the catch was sorted, survived to be caught again in a subsequent haul. Available data indicate that only about 25 percent or fewer of discarded yellowtail survive when they are unwounded (Lux, 1968). Survival of discarded bitten fish undoubtedly would be much lower. Therefore it would be difficult to account for the large numbers of bitten yellowtail that the fishermen observed, except through predation that was largely outside of the trawl. However, we do not rule out the possibility that trawling operations sometimes attract bluefish, as they sometimes attract other fish or sea birds, or that trawling may make flounders more available prey for bluefish.

Winter Flounder Wounds

Few of the other coastal fisheries, such as winter flounder and summer flounder, Paralichthys dentatus (L.), were caught in the area where wounded yellowtail were observed. This was because the water there was deeper than on their usual summer and fall grounds. Therefore, there were no reports of wounds on other flatfishes. Captain Edwards told us, however, that while otter trawling in Gardiners Bay, Long Island, in 5 to 6 fathoms (9 to 11 meters) of water in late May 1970, he caught a few winter flounder that had wounds like those of the yellowtail. Bluefish had just arrived in large numbers in the area, he said, and it was his view that they had inflicted the wounds on the winter flounder.

Over a period of years, Atlantic coast fishermen have been very helpful in bringing to our attention a large number of flatfishes with various morphological anomalies. Causes for most of these remain unknown. Among the records, however, are anomalies in two winter flounder. These, in the light of information presented above, possibly can be explained as resulting from wounds by bluefish that subsequently healed.

The first of these fish was 28 centimeters total length and was caught by otter trawl near Nantucket Shoals (approximate position 41°10' N, 70°10' W) in spring 1959. It had neither caudal peduncle nor caudal fin (Figure 3). If this anomaly was caused by a wound, it was completely healed. The fish looked as though the caudal part might have been bitten away, as in the case of one of the yellowtail caught in September 1971 (Figure 1e), and the ends of the U-shaped wound came together on healing.

The other winter flounder (Figure 4) was 35 centimeters total length and caught by

Fig. 3 - Winter flounder, caught near Nantucket Shoals in 1959, without caudal fin or caudal peduncle.

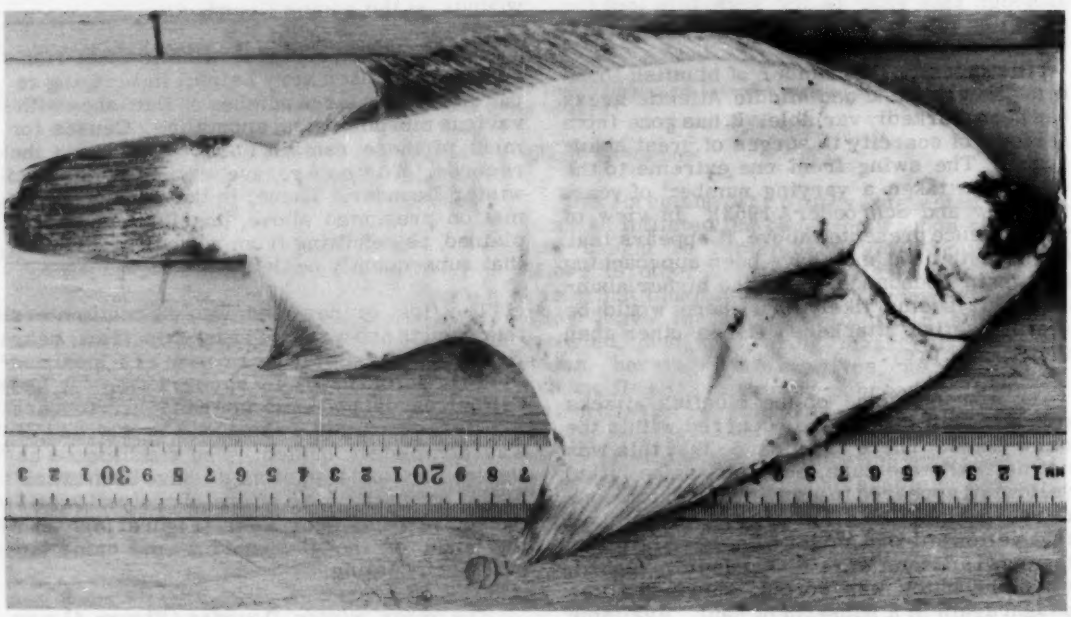

Fig. 4 - Winter flounder, caught in Block Island Sound in June 1960, with healed wound or other anomaly on the caudad ventral edge and with a deficiency of pigmentation.

otter trawl in June 1960 in Block Island Sound. It looked as though it could have suffered a wound like some of the other bitten yellowtail (Figure 1a, 1b, and 1c[1/]. If this was a wound, it also was healed entirely. However, there remained a marked upward curve in the spinal column above the affected area. In addition, this fish was pigmented only on a few scattered areas, notably on the end of the head and on the fins. Whether or not it suffered a loss of pigmentation because of injury is unknown. Wounds and skeletal abnormalities, however, have been reported in association with pigmentation deficiency in a number of flatfishes (Dawson, 1967).

Another winter flounder, 24 centimeters in total length, with a bite-shaped piece missing from its dorsal edge and with a pigmentation deficiency similar to that of the fish of Figure 4, above, was reported by Breder (1938) as being caught near Bayside, New York, in November 1938. Breder suggested that this fish had a healed bite wound. If so, it seems quite possible that it was bitten by a bluefish.

It appears likely that more information on flatfish wounds and their effects will come to light during the next year or two, considering current bluefish abundance. Assuming that we obtain sufficient records of wounded fish, we may be better able to explain certain flatfish anomalies.

ACKNOWLEDGMENTS

We thank Captains Edwards and Rebello and other members of the fishing industry who provided specimens and information for this report.

1/The wounded yellowtail flounder collected in September 1971 (Figure 1), the bluefish and stomach contains collected in November 1971 (Figure 2), and the winter flounder with a possible healed wound collected in June 1960 (Figure 4) are deposited in the U.S. National Museum under catalog numbers USNM 207038, USNM 207037, and USNM 207036, respectively. The winter flounder with the tail missing that was collected in 1959 (Figure 3) was unintentionally discarded.

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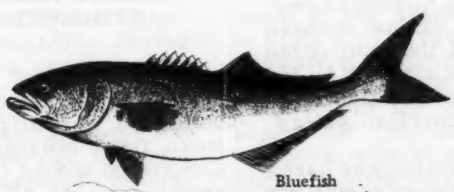

Bluefish
(Pomatomus saltatrix)

NMFS ALBACORE TUNA FORECAST & RESEARCH PLANS FOR 1972

R. Michael Laurs

Based on environmental conditions and the trend in the historical record of commercial albacore catch distribution, fishery scientists at the NMFS La Jolla Laboratory predict that the major portion of the albacore catch during the 1972 season will be taken in waters south of San Francisco. It is estimated that 70 to 80% of the total catch will be south of San Francisco, with most of it off central California. Therefore, only 20 to 30% of the total catch is expected to be made north of San Francisco, which is below the long-term average of 36%. Between 30 and 45 million pounds will be caught by commercial boats south of San Francisco; between 10 to 15 million pounds north of the city. However, these estimates of albacore landings could be low if many more boats enter the commercial albacore fishery.

Sports boats operating in southern California waters should have very good albacore fishing this season. However, warm-water conditions could develop in southern California waters in late summer and limit fishing success.

NMFS' 12TH Annual Prediction

This is the 12th annual fishery prediction by NMFS (formerly Bureau of Commercial Fisheries) for the albacore tuna fishery off the North American Pacific coast. The prediction of the general distribution of the albacore fishery is based partly on an experimental index developed at the NMFS La Jolla Laboratory. This relates the north-south distribution of the fishery with environmental conditions during the spring months in certain offshore waters. The method is based partially on the assumption that mid-ocean environmental conditions encountered by incoming migrants affect the distribution of the fish when they enter North American waters.

In past years, the prediction was based solely on sea-surface temperature conditions observed in spring in the near-shore waters where the summer albacore fishery traditionally takes place. The earlier method was based on the assumption that trends in environmental conditions observed in spring persist and indicate the probable distribution of sea-surface temperature in mid-summer. However, experience has shown that dynamic air-sea interaction processes during summer can alter considerably temperature conditions observed during the spring period prior to the fishing season.

The estimates of tonnages expected to be landed during the 1972 albacore fishing season are based on statistical calculations with historical data. Current population dynamics research underway at the NMFS La Jolla Laboratory and elsewhere should enable us in the near future to make more accurate forecasts of tonnage and general size of the fish that will enter the fishery.

AVERAGE SEA-SURFACE TEMPERATURE

The 12-year average (1960-71) of optimum temperature zone for albacore in the July 1-15 period is shown in shaded portion of Plate 1. The majority of albacore caught in North American waters are taken in waters of this temperature range. Prevailing weather during this period in 1972 will likely cause deviations from this average pattern, which will influence the distribution of albacore. We will monitor the evolving temperature patterns in order to project the albacore distribution as the season develops.

RECENT TRENDS IN OCEANIC & ATMOSPHERIC CONDITIONS

During the last 2 weeks of May, sea-surface temperatures along the North American coast were slightly below the long-term mean from northern Washington to Point Conception and out to 130° W. Colder temperatures about 2° F below the long-term mean occurred offshore Vancouver Island,

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and in localized coastal areas off Cape Blanco and between Point Arena and Monterey. Sea-surface temperatures were slightly above the long-term mean south of Point Conception to central Baja California and out to 125° W--except for a region along the coast and south of Ensenada, where temperatures were below the long-term mean. The 60° F isotherm was near its normal position, except between about 125° and 130° W, where it was displaced to the south (Plate 2).

During the winter of 1971-72, thermal conditions in the eastern North Pacific were characterized by a "warm pool" of above-normal temperatures over a large central region between latitudes 25° and 50° N and to the west of longitude 140° W; below-normal temperatures prevailed in a broad zone extending southward from Gulf of Alaska along North American coast and westward towards Hawaii south of 25° N. These conditions resulted in a strong east-to-west thermal gradient and were indicative of increased flow in the California Current system.

Strong Thermal Contrast Dissipates

In March 1972, this strong thermal contrast began to dissipate, with the "warm pool" shifting eastward and southward. It diminished further during April 1972 as warm temperatures in the central oceanic regions and cool temperatures along the coast edged closer to normal values. By the end of May 1972, remnants of the above- and below-normal temperature regions were present but greatly reduced in size and intensity from the previous winter.

The evolution of these changes in the large-scale thermal conditions of the eastern North Pacific can be linked to abnormal circulation patterns in the overlying atmosphere throughout winter 1971-72 and spring 1972. During late winter and spring, the erosion of the large pool of warm water resulted from stronger-than-normal north to northwesterly winds. These transported cooler water into the area and caused above-normal heat loss from the ocean through increased evaporation. In addition, the strong north-northwesterly winds that occurred in offshore coastal regions throughout the winter abated, and colder-than-average water in the areas returned to more normal values.

According to the Extended Forecast Division of the National Weather Service, northerly winds offshore of southern Oregon and California are expected to be stronger-than-normal during June 1972. The above-normal north-northwesterly winds should retard seasonal warming of surface waters through increased upwelling, evaporative cooling, and southerly transport of water from the north. These effects could result in cooler-than-normal surface temperatures along the coast and upwelling could favor local biological enrichment for production of adequate tuna forage.

HISTORICAL TRENDS IN CATCHES

Plate 3 is a bar graph showing total landings of albacore tuna for the Pacific west coast (U.S. and Canada) for 1938-71. The graph does not take into account changes in fishing effort and efficiency or availability. West-coast landings for the 1971 season, based on preliminary information, were 53.4 million pounds. These were slightly lower than the 1970 total of 57.5 million pounds and higher than the 1962-71 average of 50.0 million pounds. Although exact data are not available, rough weather during parts of the 1971 season and unavailability of fish near the season's normal end tended to limit fishing activity and success for individual boats. The 1971 season was shorter than in 1970. According to the Western Fishboat Owners Association, more vessels fished for albacore in 1971 than in recent years. Thus, although 1971 west-coast landings were down only slightly from 1970, catches by many individual fishermen were markedly lower. A further increase in fishing effort is expected this year because many boats are planning to enter the fishery.

The percentage of the west-coast catch north of San Francisco in 1938-71 is shown in Plate 4. The percentage north-south distribution of the catch reflects the large shifts in location of the centers of the albacore fishery over the last three decades. It appears that the fishery is shifting back to southern waters after being centered in northern waters in recent years. The fishery swung northward in 1965 and reached its peak in 1968 and 1969, when 85% of the catch was north of San Francisco, mostly off Oregon and Washington. Last year, about 36% of the west-coast catch, which is near the long-term average, was north of San Francisco.

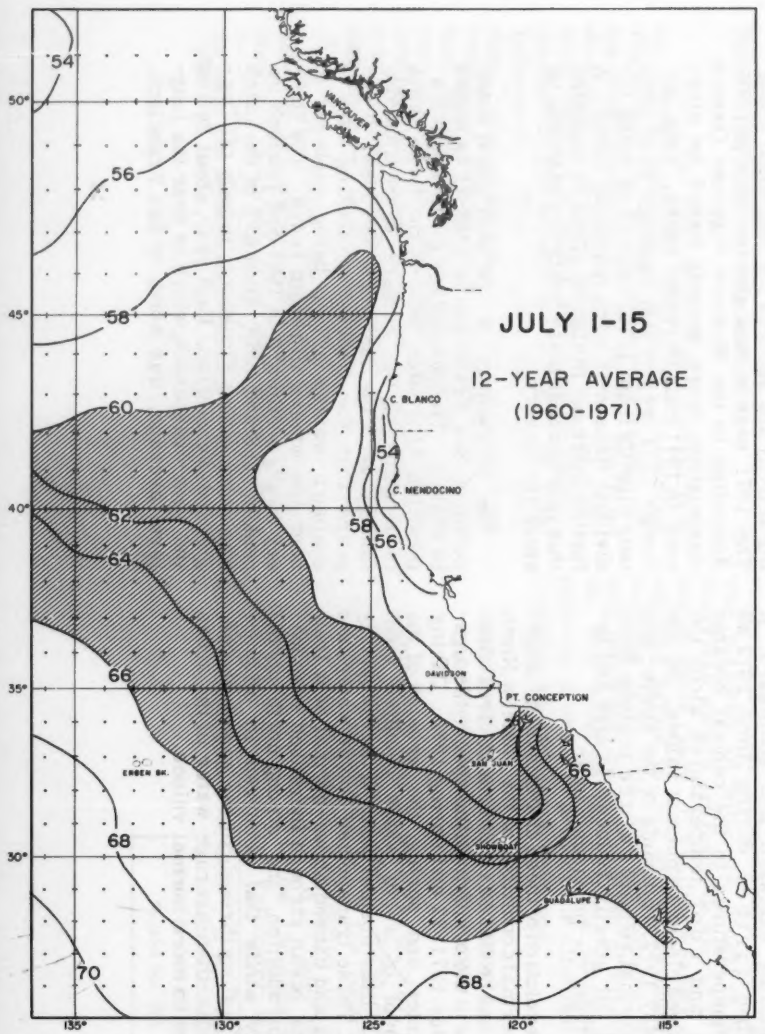


Plate 1.--Average sea surface temperature fields for the July 1-15 interval. Shaded zone delineates region where most of the albacore would be available under these conditions.

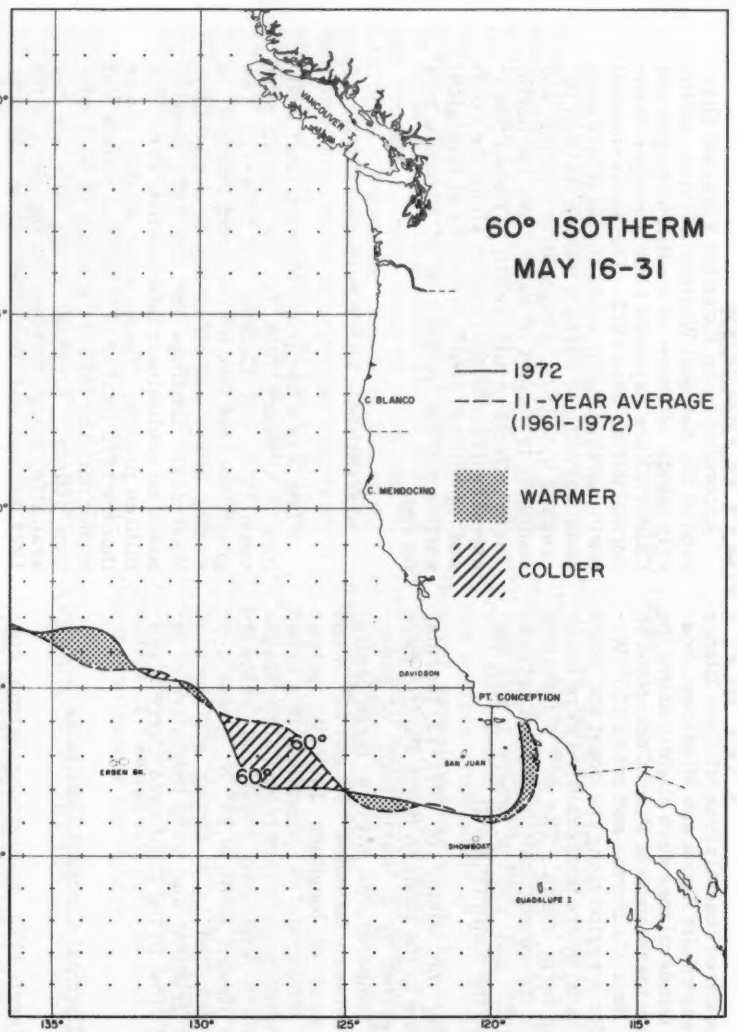
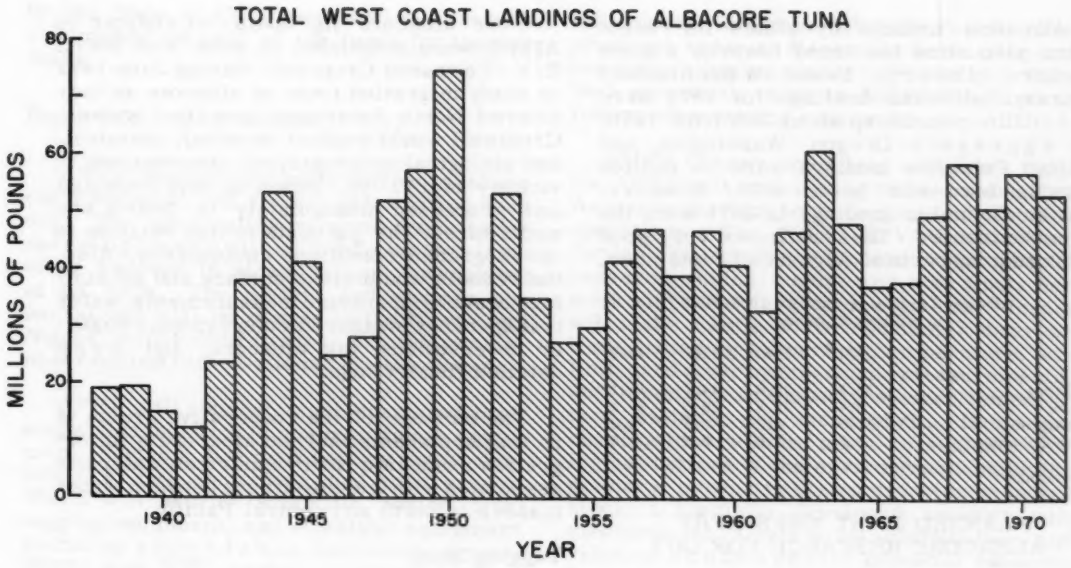


Plate 2.--Relation of position of May 16-31, 1972, 60°F. limiting isotherm to long-term average position for the same interval.



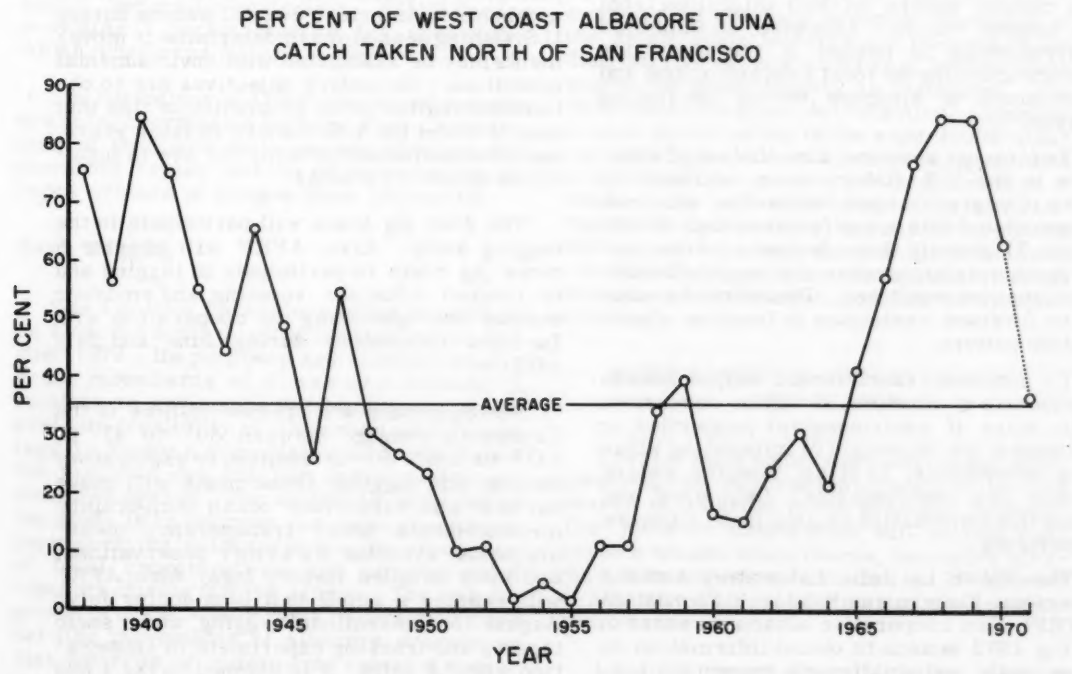


Plate 3. --Top graph: Total west coast landings of albacore tuna in millions of pounds, 1938-1971.

Plate 4. --Bottom graph: Percent of west coast albacore tuna catch taken north of San Francisco, 1938-1971.

Albacore landings by states for recent years also show the trend towards a more southern fishery. Based on preliminary figures, California landings for 1971 were 38.4 million pounds, up about 28% from 1970; the aggregate Oregon, Washington, and British Columbia landings were 15 million pounds, down 46% from 1970. However, British Columbia landings in 1971 were the highest on record. These reflected very good fishing during parts of August and September.

Albacore Landings by State for 1968-71
(in millions of pounds)

	1971*	1970	1969	1968
California	38.4	29.9	14.7	15.1
Oregon	8.4	21.8	29.8	37.8
Washington	2.9	4.3	3.5	3.0
British Columbia	3.7	1.6	2.5	2.6

*Preliminary.

PLANNED JOINT NMFS-AFRF ALBACORE RESEARCH FOR 1972

To expand the U.S. albacore fishery earlier in the season, a better understanding is needed of where albacore enter North American coastal waters on their migration from the central Pacific. Likewise, an improved understanding is needed of the underlying factors affecting the local concentrations and movements of albacore during the fishing season.

To forecast seasonal distribution of albacore in the U.S. fishery area, we must: 1) learn if migration route followed by albacore is associated with ocean features and, if this is so, 2) identify these features so they, or environmental processes that may influence them, may be monitored. This should enable us to forecast variations in location of migration pattern.

To forecast short-term, within-season movements of albacore, it will be necessary: 1) to learn if environmental properties or processes are important in influencing albacore movements; 2) if so, monitor and/or predict key environmental indicators, and 3) use this information to anticipate albacore movements.

The NMFS La Jolla Laboratory and the American Fishermens Research Foundation (AFRF) plan cooperative albacore research during 1972 season to obtain information on large-scale and small-scale migratory patterns of albacore.

Four albacore jig boats, on charter to AFRF, were scheduled to work with NMFS R/V 'Townsend Cromwell' during June 1972 to study migration route of albacore as they entered North American coastal waters. Cromwell would conduct physical, chemical, and biological oceanographic observations in vicinity of 140° W. Based on data collected and processed immediately on board, she would direct the jig boats to fish relative to oceanographic conditions encountered. Also, the vessels would make surface and subsurface ocean temperature measurements, water transparency measurements, synoptic weather observations, tag albacore, and keep detailed fishery logs.

The purpose of the cooperative cruise is to test hypothesis that the albacore's immigration route into North American waters is associated with transition zone between water masses in north and central Pacific.

Tagging Study

The La Jolla Laboratory is also directing an albacore-tagging study. It is designed primarily to examine movements of albacore within North American coastal waters during U.S. fishing season and to determine if movements may be associated with environmental conditions. Secondary objectives are to obtain information on the proportion of fish that may re-enter the U.S. fishery in later years, and information on mortality for use in population dynamics studies.

The four jig boats will participate in the tagging study. Also, AFRF will charter 8 more jig boats to participate in tagging and to conduct albacore scouting and environmental data-gathering in cooperation with La Jolla Laboratory during June and July 1972.

The 8 jig boats will operate inshore of the Cromwell, roughly between 30° to 47° N, 127° to 135° W. In addition to exploratory fishing and tagging, these boats will make surface and subsurface ocean temperature measurements, water transparency measurements, synoptic weather observations, and keep detailed fishery logs. Also, AFRF will charter a small bait boat during July-August for conventional tagging, and a sonic tagging and tracking experiment in cooperation with La Jolla. It is planned to tag 4,000 to 5,000 albacore. NMFS was granted $10,000

by the State of California Marine Research Committee as part of the funds for tagging study.

Radio Information Ashore

AFRF-chartered vessels will radio ashore environmental and fishery information each day. The information received from the cooperating vessels will be used with that from other sources in albacore-tuna forecasting at La Jolla. The BATHY and weather observations will be passed to the Navy Fleet Numerical Weather Central, and the weather observations to the National Weather Service.

AFRF will supply to each chartered boat single side-band radio communication equipment, portable live-bait holding tanks, certain fishing equipment, and wind gauges. NMFS will provide scientific advice, fish-tagging equipment, and scientific equipment, including expendable bathythermographs (XBT) and XBT probes (supplied by Navy Fleet Numerical Weather Central, Monterey, California), thermograph (one boat), bucket thermometers, secchi disks, and radio facsimile recording equipment. NMFS is also providing 7 technicians to tag aboard the AFRF-chartered fishing vessels.

The operations of AFRF-chartered vessels are being coordinated with the Fish Commission of Oregon's early-season albacore exploratory cruise and the albacore-oceanography cruises of Oregon State University.

Sonic Tagging

The La Jolla Laboratory plans to conduct an albacore sonic-tagging experiment in August 1972. Its purposes are to study small-scale movements of albacore schools in relation to environmental conditions; and to evaluate feasibility of fishermen using sonic tags to locate a school(s) of albacore fished the previous day but lost during nighttime, shutdown period. The scientific objective of the study is to improve our understanding of the underlying factors affecting the prediction of local concentrations and movements of albacore during fishing season. The results should provide considerable information concerning movements of albacore schools on diel patterns of movement, rates of movement, how much time a school spends at the surface, and environmental factors that may influence movements. All these results have practical value to fishermen in locating and catching albacore more efficiently. They have scientific value to NMFS scientists in fishery-forecasting research.

NMFS fishery scientists will work from the AFRF bait boat during the second half of August to conduct sonic tagging and tracking operations. The NMFS R/V 'David Starr Jordan' will conduct albacore-oceanography research during August and coordinate her work with sonic-tagging experiments. Jordan will make a suite of environmental observations including subsurface temperature, salinity, and other hydrographic measurements, and monitor continuously surface temperature, salinity, and chlorophyll. Numerous observations will be made to evaluate biological factors of the environment, including primary productivity, zooplankton standing stock; a specially developed sampler will measure the small-scale distribution and relative abundance of potential albacore forage organisms.

Also, it is planned to use a light aircraft equipped with an airborne radiation thermometer to obtain a synoptic evaluation of the small-scale features and changes in the distribution of sea-surface temperature where the sonic tagging is conducted. The McDonnell-Douglas Astronautics Company is also participating in the experiment making overflights with an aircraft equipped with a multispectral scanner for measurement of ocean color and other data. The environmental data gathered by Jordan and the planes will be used to determine if environmental conditions influence or control small-scale movements of albacore, as indicated by sonic tracking.

NMFS ADVISORY OPERATIONS FOR 1972 SEASON

The La Jolla Laboratory will issue albacore advisory information throughout the 1972 season in addition to the seasonal forecast. The advisory information will include sea-surface temperature charts, narrative albacore fish bulletins, and daily broadcasts of albacore fishing information over marine radio bands.

La Jolla issues the publication 'Fishing Information' monthly. It contains charts of sea-surface temperature for the North

Pacific and eastern tropical Pacific, sections of subsurface temperature structure for parts of the North Pacific, charts of winds and pressures for the eastern North Pacific, a narrative description of pertinent temperature conditions, and fishery advisory information.

The albacore fish bulletins will be issued twice each month from June 15 until the season ends, in conjunction with 15-day sea-surface temperature charts. The 15-day sea-surface temperature charts, now issued year round, cover the area roughly between central Baja California and Vancouver Island out to 135° W. The bulletins will include short-term projections of albacore distribution and locations of productive fishing areas, information on oceanographic and atmospheric conditions, and other information. The NMFS fishery advisory materials are mailed to fishermen upon request and are bulk-mailed to fish buyers and processors for further dissemination to fishermen.

Daily Broadcasts

Again this year, daily broadcasts of albacore fishing information will be prepared by La Jolla and transmitted over marine radio bands. The broadcasts were scheduled to be made twice daily on weekdays, and once on Saturday mornings, from June 12 through October 31, or until the albacore season ends. The broadcasts will include the latest albacore fishing information obtained from research vessels, cooperating fishing vessels, and unloading station operators. Highlights will include location of active centers of fishing, typical fishing scores, size of fish, sea-surface temperature and subsurface temperature information when available, and other information. Sport-boat activity will be included.

A weather and sea-state summary tailored to fishermen's needs and prepared by the National Weather Service will be given. It wil include large-scale weather features and long-range outlook, regional wind, weather, and sea-state conditions for offshore waters, and storm development. In addition, for each 15-day period, the broadcast will include map coordinates for the 15-day average position of the 60° and 64° F isotherms for the region east of 130° W longitude and between 25° and 50° N latitude. The broadcasts will be made on weekdays and Saturday mornings by the following radio stations:

WWD (La Jolla, California) on AM compatible frequency 4409.4 and on SSB carrier frequencies 4409.4, 8644.1, 8789.6, and 13147.5 kHz at 0600 and 1945 PDT.

KMX (Astoria Marine Operator) on 2598 kHz at 0630 and 1945 PDT.

KRED (Eureka, California) on commercial AM 1480 kHz at 0600 and 2000 PDT.

The success of the albacore advisory program depends on the input of timely, first-hand information from fishermen at sea and dock operators and processors. Fishermen are encouraged to report oceanographic, weather, and fishing information. As a channel of communication for such information, radio station WWD will operate the following voice single side-band frequencies and schedules:

Carrier frequencies	
WWD transmit	WWD receive
4409.4	4410.8
8789.6	8255.6
13147.5	12368.5

Hours of operation are 0400-0100 local time, 7 days per week, including holidays. Information may also be radioed to the Western Fishboat Owners Association. The NMFS La Jolla Laboratory will accept collect calls from fishermen at sea to report oceanographic, weather, and fishing information.

INTERNATIONAL

ICNAF PROPOSES 1973 QUOTA LEVELS

At its 22nd annual meeting, in Washington, D.C., May 25-June 2, 1972, the International Commission for the Northwest Atlantic Fisheries (ICNAF) agreed on the proposed regulation in 1973 through national quota shares of 8 stocks of cod, yellowtail flounder, and hakes of major interest to U.S. fishermen off New England; also, on division of an overall quota for 6 other stocks of cod, American plaice, and yellowtail flounder fished by other nations off Canada.

Scientists are concerned over the condition of cod stocks throughout the Convention Area. They say that almost all are being fished close to the point of maximum yield. The catch quotas proposed for cod and other species are designed to prevent overfishing.

All member countries were represented: Canada, Denmark, France, W. Germany, Iceland, Italy, Japan, Norway, Poland, Portugal, Romania, Spain, USSR, United Kingdom, and U.S. Observers represented Bulgaria, Cuba, the International Council for the Exploration of the Sea (ICES), FAO, and the International Pacific Halibut Commission (IPHC).

ICNAF, established in 1949, has authority to propose high-seas regulatory measures. These become effective for all member countries that do not object to them.

New ICNAF 1973 Quotas Proposals

	Principal Location of Stock	Overall Quota	U.S. Share
	ICNAF Division[1/]	Metric Tons	
Cod	2J, 3K, 3L	575,500	
Cod	3PS	50,500	
Cod	3N, 30	103,500	
Cod	4VS, 4W	60,500	1,050
Cod	5Y	10,000	9,400
Cod	5Z	35,000	19,600
American Plaice	3L, 3N, 30	60,000	100
Yellowtail Flounder	3L, 3N, 30	50,000	100
Yellowtail Flounder	Subarea 5, E. 69° W.	16,000	15,000
Yellowtail Flounder	Subarea 5, W. 69° W.	10,000	9,000
Silver Hake	5Y	10,000	9,500
Silver Hake	5ZE	80,000	17,000
Silver Hake	5ZW	80,000	25,000
Red Hake	5ZW	40,000	15,000

1/ The ICNAF Convention is divided into 5 Subareas, encompassing waters off: West Greenland--Subarea 1; Labrador--Subarea 2; Newfoundland--Subarea 3; Nova Scotia--Subarea 4; and New England--Subarea 5. Each Subarea is divided further into Divisions with alphabetical designations. In Subarea 5, these include Division 5Y (Gulf of Maine); 5ZE (Georges Bank) and 5ZW (Southern New England).

How Quotas Were Determined

National quota shares generally were determined by a formula that allocated 80% of the quota on the basis of historical performance in the fishery. Equal weight was given to 10-year long-term and 3-year short-term periods; the remainder was divided between a preference for coastal countries and an allowance for miscellaneous factors, such as new entrants into the fishery and the catch of nonmember nations.

The Commission recommended continuation in 1973 of overall haddock catch quotas of 6,000 tons in Subarea 5, 9,000 tons in Division 4x, and 4,000 tons in Division 4w. In this case, members felt the quotas were too small to justify formal allocation. However, the Commission noted that only the U.S. and Canada planned a directed fishery for haddock. Also, a small portion of the existing area off Massachusetts closed during March, April, and May to vessels capable of catching bottomfish such as haddock was reopened to avoid interference with other fisheries.

The Hakes

In addition to national quotas for red hake and silver hake, the Commission agreed to continue a seasonal ban on fishing for hakes in that part of Subarea 5 south of Nantucket Island bounded by 69°W., 39°50' N, 71°40' W., and 40°20' N. In 1973, however, this closure is to apply during April rather than January-March as in previous 3 years. April is one of principal periods when hake concentrate offshore in prespawning aggregations before moving to inshore waters where U.S. fishermen operate.

Georges Bank Scallop

Members agreed on the regulation of the U.S.-Canadian Georges Bank scallop fishery. Scientists have warned that scallops are being harvested at sizes that do not permit the maximum potential yield. The proposed recommendation provides for a minimum shell size (95 mm) and minimum average meat weight (11.3 grams) for all scallops harvested.

Mesh Size Increased

The Commission also recommended to increase mesh size requirements of the applicable trawl regulations in Subareas 4 and 5 to 130 mm or $5\frac{1}{8}$ inches (manila) in the codends of nets. Existing mesh requirements of 114 mm, or $4\frac{1}{2}$ inches, would continue in other parts of net. New mesh requirements in codend would become effective Jan. 1, 1974, except in Division 4x, where date will be determined at 1973 Annual ICNAF Meeting. (Trawl regulations apply in Subarea 5 for cod, haddock, and yellowtail flounder; in Subarea 4 for cod, haddock, witch, yellowtail flounder, winter flounder, and American plaice.) In ICNAF Subareas 1, 2, and 3, 130 mm mesh requirements for regulated species are in effect.

Atlantic Salmon Agreement

The Commission voted to incorporate in an ICNAF proposal the substance of a U.S.-Danish agreement on Atlantic salmon concluded Feb. 5, 1972. It provides for a complete phase-out of the high-seas fishery for this species over 1972-75; the catch by local Greenland fishermen will be held at 1964-71 average.

OECD FISH CATCH ROSE SLIGHTLY IN 1971

In 1971, the 19 member nations of the Organization for Economic Cooperation and Development (OECD) caught about 23 million metric tons, a slight gain over 1970. This is reported in OECD's "Review of Fisheries, 1971". The landings for the food market (nearly 17 million tons) and for industrial purposes (6 million tons) were about the same.

The 202-page report covers major fishery developments. It provides information on production, fleets, marketing, external trade, and government assistance.

The stocks in most main fisheries were reported less plentiful. Measured by the effort applied, the catch rate often was below 1970's. So fleets were redeployed from one fishing area to another, or from one species to another.

Cod

The fishery for spawning cod in North Norway rose 50%. The plaice fisheries in the Barents Sea cod fishery declined sharply; more effort was applied by some fleets to grounds around Iceland.

For many countries, shellfish continued to be a major source of revenue. More effort was concentrated on catching crustaceans and molluscs.

Rising Costs

Rising operational costs were offset, to some extent, by higher product prices. The very good 1970 production record set by fish meal and oil in the North East Atlantic was exceeded in 1971 in Denmark and Norway. However, fishermen supplying the reduction factories received lower prices than in 1970.

The prospect for any significant addition to present supply levels are not good. Landings are not higher than 1971 levels, so, to meet demand, OECD countries are looking outward for fishable stocks and for more supplies from developing countries.

Trade Trend Continues Upward

The trade in fishery products has been upward for many years and 1971 was no exception. The value of OECD imports will exceed $2.5 billion, up 7% from 1970. Exports will approach $1.9 billion, up 12%. The higher values of foreign trade were due mainly to increasing prices.

The import trade continues to be dominated by the U.S., the United Kingdom, Japan, and France; these took 72% of all imports. Japan, a leading exporter, is followed by Norway, Canada, and Denmark; Japan exported about two-thirds of total OECD exports.

UNITED KINGDOM 1971 CATCH STEADY, VALUE UP

Landings in the United Kingdom during 1971 were at 1970 level, but value rose nearly 24%. Demersal species declined slightly, but total value rose due mainly to a large rise in landed value of cod and haddock. Decreased cod landings from distant-water operations were offset somewhat by increased landings of haddock and whiting. Landings of pelagic species rose 7% above 1970. This was attributable mainly to greater landings of sprats.

A decline in England's herring landings was compensated for by increased Scottish landings from the west coast of Scotland and Shetland. Shellfish landings remained at about 1970 level, while total value rose nearly 16%.

In Distant Waters

Catch rates on some distant-water grounds fell significantly from 1970. Yields from near and inshore waters remained generally satisfactory.

Vessel operations in distant-water areas traditionally include Bear Island, Spitzbergen, Norwegian coast, Iceland, East Greenland, and the Northwest Atlantic. The distant-water fleet, including freezer vessels, operated mainly in the Barents Sea, and on the grounds off Norway and Iceland.

In 1971, the UK banned herring fishing in North Sea and Skagerrak, except under license during May, and from August 20 to September 30. Effective Nov. 15, 1971, a ban was imposed on purse-seining for herring in an area south of Ireland.

Changes in Fleet

The trend in fleet composition in recent years has been a decrease in number of deep-sea "conventional" trawlers, a steady increase in inshore vessels, and a gradual increase in freezer trawlers.

In 1969-1970, construction of deep-sea vessels remained low. Only 5 new vessels were added.

The total inshore fleet (40-79 ft.) increased to 1,643 vessels by 1971, the near water fleet (80-109 ft.) declined to 176 vessels, and middle water fleet (110-139 ft.) dropped slightly to 174 vessels. Near waters are those along coast of UK, Scotland, and North Sea. In 1970 and 1971, the fishing effort continued concentrated in North East Atlantic. Distant-water wetfish vessels 140 ft. and over totaled 126 by 1971; also, there were 36-freezer-factory vessels.

Plans include construction of two fillet-freezing stern trawlers (248 ft.) to be completed in 1972. This would bring to 8 the number being built or on order in the U.K. Four 213-foot vessels also were under construction in 1971. Two 197-foot vessels were being built in Norway to operate from U.K. ports in early 1972.

The 240-foot, all-freeze, over-the-stern-part factory trawler. Owned by Britain's Boston Deep Sea Fisheries Ltd.

THE OCEAN--A SOURCE OF TASTY FOODS

Sergei Snegov

The Central Scientific Research Institute of Information and Technico-Economical Studies in Fisheries has a laboratory that will interest even the layman. A team working under Lidia Borisochkina, Cand. Sc. (Technology), is studying the techniques for processing fish and other sea products. Every buyer of sea foods in the shops becomes acquainted with the work of this team.

What is fish like? It is a tasty dish. Fried fish, boiled fish, smoked and dry-cured. There is a lot more to know about it. However, the chemist will kill the gourmandise by saying:

"Fish flesh contains nitrogenous extractive (soluble) compounds. It is they that give taste and aroma to the dish that stimulate the excretion of gastric juices and improve the appetite."

It is wholesome. It contains all the essential substances needed for the vital activity of the human body. Proteins. Some pelagic fish that inhabit the surface layers (not the bottom-dwelling fish) have 22-24% protein content. More than the freshwater fish. Fish flesh offers all necessary amino acids, just like the flesh of domestic animals. Edible fish oil, as distinguished from the fats of birds and animals, is characterized by a liquid state at room temperature. Therefore, it is easier to assimilate. Besides, it includes a whole complex of unsaturated fatty acids, such as linoleic, linolenic and arachidic acid--so-called vitamin F, known for its anti-sclerotic properties.

The Universal Pharmacist

The word "medicinal" has suggested itself. Fish can be a real medicine. Fish, crustaceans, molluscs, and seaweed are stores of vitamins A, D, and B-group. They get it from the ocean--the universal pharmacist. No other foods in the human diet contain such a collection of mineral elements that play an important physiological role. Fish contains iodine, manganese, copper, bromine, fluoride, cobalt, potassium, calcium, magnesium, and phosphorus.

For instance, cod fillet contains iodine in a proportion of 800 to one, or even 2400 to one, as compared to beef. UNESCO experts maintain that two of three diseases, including goiter, which have afflicted 200 million people, should be treated with different foods obtained from the sea.

Preserving Fish Properties

Fishermen catch fish several thousand miles from home. To preserve the splendid properties, a variety of techniques is used.

Freezing above all. It appears simple enough: freeze the fish and it will be preserved. But it is far more difficult, really. No cooling improves the properties of sea foods. The problem is to select conditions which would reduce the losses to a minimum. Besides, fish loses 4 to 6% in weight if temperature in freezing chamber is lowered by forced circulation of cold air. The freezing rate is also important. The quicker the freeze, the smaller the quantity of protein affected by irreversible transformation. Preserving the catch depends on many factors, even on the mechanical characteristics of ice. Chipped ice, for instance, can damage the fish. The use of lamellar ice out of snow offers the best possibilities.

In the past, fish was frozen and preserved at a temperature of minus 6-10° Centigrade. Today, the practice is to maintain the air temperature at minus 30-40° and the temperature of the fish at not higher than 18°. A most promising quick deep-freeze technique is the liquid nitrogen method. It is used for the more expensive products, such as shrimps, lobsters, spiny lobsters, and ready-made foods. This technique forms tiny ice crystals

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in the tissue, the juice remaining in the flesh. After the foods are unfrozen, they meet the most exacting requirements of the strictest tasters. The gastronomical properties of the food suffer no loss at all.

Augmenting Freezing Process

To augment freezing, experts sometimes resort to "exotic" substances, such as bee glue--propolis. It consists of resins (more than half the content), wax, and fragrant essential oils. It is characterized by anti-oxidizing properties. Sturgeon, white salmon, and muksun salmon are washed in a solution of propolis and then frozen. After that, they are glazed in a mixture of bee glue and citric acid. After 10 months' storage at minus 20-25 degrees Centigrade, the fish's nutritive and gustatory values are fully preserved.

The problem of quick defreezing is not easy either. Numerous techniques have been tried. For instance, fillet layers have been "thawed out" in vaccum chambers with steam. Good results have been produced by experiments in defreezing sprats with commercial frequency current. These experiments were conducted by the All-Union Scientific Research Institute of Fisheries and Oceanography.

The prospect of removing the elaborate and costly refrigerating plants from the ships and shore storage centers is highly tempting indeed. What "force" can oppose the destructive effect of the microorganisms, oxidation of fats, and decomposition of proteins? The scientists are searching for fundamentally new means and techniques.

Radiation As Preservative?

Is radiation harmless as a preservation agent? For 20 years, researchers have tried to find an affirmative answer. Ionizing radiation inhibits the vital activity of microorganisms. But the effect of gamma, beta, and X-ray radiation and of accelerated electrons is complicated. They alter the nutritive value of the product. After certain radiation doses, so-called induced radiation occurs in it. It is necessary to establish whether it is toxic or carcinogenic or not. The microbes "die but do not surrender". Radiation may work mutation changes in them.

For more than a year, the Institute of Nutrition, USSR Academy of Medical Sciences, has been conducting an experiment in feeding white rats with fresh cod fillet subjected to gamma radiation. This ration has not produced any toxic effect on three generations of rats. However, it has been found that certain unfavorable changes have been worked in their metabolism. The sickness rate and mortality of young rats of the first and second generations is somewhat higher.

The preliminary conclusion is: radiation is an effective means for the preservation of fish foods from being spoiled. However, the scientists have not established the ultimate consequences arising from the use of irradiated fish for food. Therefore, they cannot recommend it for the table.

Experiments have followed experiments. Some have produced hopeful results. In the USSR, it has been permitted to treat some vegetable foods with radiation. Gamma radiation has been used to extend in considerable measure the storage period of potatoes, grain, and dried fruits.

When Is Fish 'Ripe'?

When is fish considered "ripe?" The food experts must know this for they need "raw material" of a definite quality. It is a fact that the chemical composition of the different fish species (mature fish, of course, not young fish) varies during the year. For instance, the fillet and liver of cod caught in the Baltic between August and February are of a much higher value than those taken in other months. Fish gains a lot of fat before the spawning season.

Atlantic herring is particularly good and suitable for processing in June, when it has fattened generously. As it matures in salting, as the process experts say, enzyme activity (enzymes are substances excreted in gastrointestinal tract) plays a special role. Thus, herring caught in June takes only one fifth the time for salting compared to herring taken in November, when fish completes its preparation for winter.

These factors are taken into account when tinned crab flesh is made. Meat taken from crabs with a hard shell is more useful and tasty than meat taken from crabs that have just changed their "armor".

Shark As Delicacy

Balyk of shark on blubber. This recipe for a tasty smoked delicacy of high nutritive value is not the product of refined gustatory fancy. It has been "designed" for two reasons: 1) The supply of those fish species to which we have long been accustomed is limited. The fishing industry is thus forced to catch other species. Most of these are oceanic fish, including shark--mako shark, grey shark, and mackerel shark, 10 species or so. 2) Should we refuse to take shark flesh, which is rich in protein and other useful substances, only because it is shark flesh? Of course, not. That would be uneconomical.

Now balyk out of shark. It looks just as tempting as smoked nototenia. It is just as tasty too. But the somewhat dry flesh of the sea robber has to be treated with up to 6% of anchovy fat or blubber. The fat has to be uniformly distributed in the cured flesh, which retains it; the fat is not subject to oxidation in the course of several months. The experimenters have developed a technique for making balyks out of cartilaginous fish that lends itself to mechanization.

Krill Added to Food

Here is a graphic illustration of a rational approach to utilization of ocean resources--the taking and processing of krill. Krill is a very small crustacean that is part of zooplankton. The food industry has been putting out so-called Korall cheese and other foods with an addition of krill paste. These foods are highly nutritive and characterized by a specific "sea" taste. The same is true of canned scallops, sea clams, and laminaria (sea kale or cabbage). The Soviet food industries produce more than 600 types of canned sea foods. The assortment has been increasing every year because more and more denizens of the sea and plants are now being used.

Fish is meat. It is also milk and poultry. It is in a sense. For meal made out of "waste" products from fish processing and canning, or from lower grades of fish, can be translated into fatter herds, additional tons of milk and eggs from record laying hens. It has been found that livestock and poultry are able to assimilate 85-90% of the protein contained in fish meal, and only 30-40% of that contained in vegetable folder.

Floating fishmeal factories are plying the northern seas. Thousands of tons of Caspian sprats are being turned into fodder additions characterized by a high caloric value, vitamin and mineral substance content.

Protein Shortage

According to United Nations, more than half the population of the planet now suffers from a shortage of protein in the diet. It has been calculated that the ocean is capable of supplying four-fifths of animal protein, not one-fourth as today. Several hundred researchers of many countries are now tackling the problem of saving humanity from protein deficiency.

Fish protein concentrate (FPC) is one of the solutions to this problem. The "extract" should contain a dozen or more essential amino acids. It should be totally free of fish smell. It should be soluble in water. What is most important, it should be cheap. Soviet researchers at the Technological Institute of Fisheries in Astrakhan (delta of the Volga) have developed a process which ensures the above properties.

The food concentrate produced there is free of fat, the main source of the specific fish smell. Even after prolonged storage, the "smell of sprat" is not restored. When dissolved in water, the concentrate is characterized by froth-forming power. This is essential for the bread-baking industry. The "Kaspiiski" oblong loaf and the "Snetok" roll enriched with protein have proved a success. A 2% addition of the concentrate has increased the lysine (a vital amino acid) content by 58%, vitamin B_1 by 69%, calcium by nearly 40% and iron by 64%. At the same time, the price has gone up negligibly.

They say that the fish protein concentrate has a splendid future. Experts maintain that it will increase the caloric value of bread and confectionery, including biscuits and creams. More than that, it may even replace milk and cream in ice cream. FPC will be added to soft drinks.

Neptune is not in a hurry to open the doors of his store rooms to man. But he is a good host to guests who are ingenious and thrifty.

MEXICO STARTS NEW PROGRAM TO TRAIN FISHERMEN

Mexico is initiating a program in September 1972 to train young men to be fishermen. It is part of an overall plan to fully develop marine resources. Conducted by the Ministry of Public Education, the program is headed by Dr. Jorge Carranza Fraser, Director General for Fishery Technology Training.

Thirty high schools (the secundaria level) are involved. Most of them are on both coasts, and two in inland areas are concerned with fresh-water fisheries. The program has US $1.76 million for 1972 and US$5.6 million for 1973. Each school will accommodate 60 students, a total of 1800.

The Curriculum

Although the 3-year secundaria course includes normal high-school subjects, the emphasis is on fishery subjects. These include gear and methods, fishery planning and development, technology of processing and handling, aquaculture, boat handling, piloting, engine operation and maintenance, and basic electronics.

Following these 3 years, students who decide to continue into a fishery career (it is not mandatory) will advance to higher levels including refrigeration, more electronics, and fishery research. This preparatoria level will last 3 years. Provision is made for college level and graduate work at several universities.

Several of the schools will board students at government expense. Student selection will be competitive. Fellowships will support 60% of students at day schools. This recognizes the relatively low income of coastal-town families.

Program Aids Industry

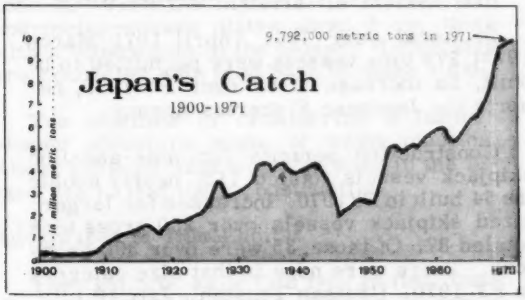
At present, there are 5 fishermen training centers in Mexico. Their achievements in terms of permanent entrants into the fishing industry have not been satisfactory. The new program is a determined approach toward injecting substantial numbers of young, motivated, and qualified fishermen into the fishing industry; it is designed to help achieve the administration's announced goal of doubling fish production by the end of 1976. (Reg. Fish. Att. U.S. Embassy, Mexico, June 22.)

ASIA

JAPAN

JAPAN'S 1971 CATCH TOPS 9.7 MILLION METRIC TONS

Fishery production in 1971 totaled 9,792,000 metric tons, a new record, Japan's Ministry of Agriculture and Forestry has announced. This was roughly 5% over 1970's 9,272,000 tons.



Type of Fishery	1969	1970	1971
	1,000 metric tons		
MARINE FISHERIES:			
Distant water	3,165	3,441	3,608
Offshore	2,948	3,234	3,512
Coastal	1,863	1,918	1,929
Sub Total	7,976	8,593	9,049
Shallow sea culture	473	515	575
Total	8,449	9,108	9,624
INLAND FISHERIES:			
Fisheries	112	-	-
Aquaculture	52	-	-
Total	164	164	168
Grand Total	8,613	9,272	9,792

Source: Suisan Tsushin, May 27, 1972.

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NMFS AGENT BOARDS JAPANESE CRAB FACTORYSHIP OFF ALASKA

On May 10, 1972, Phil Chitwood, NMFS Enforcement and Surveillance Agent, Alaska Region, boarded the Japanese crab factoryship 'Keiko Maru' 48 miles north of Amak Island in eastern Bering Sea. He reported the vessel is 444 feet long and weighs 7,516 gross tons. She carries 454 men; her fleet of catcher vessels is manned by 261 men. She fishes with 18 catcher vessels ("dokkosen") and two "kawasaki" boats used to shuttle between catcher vessels and mothership. Every 7-10 days, a cargo ship reprovisions the fleet and transports processed crab back to Japan.

The vessel departed Tokyo, her home port, March 1, 1972, began crabbing on March 13th, and is scheduled to return home on October 5th.

Production Below Normal

As of May 10, the Keiko Maru had processed 5,185 cases of king crab and 1,758,170 individual tanner crabs; her quota for 1972 is 19,148 cases (440,000 individual crabs) of king crab and 7,460,000 tanner crabs. Daily production was running at 98 cases of king crab and 38,661 individual tanner crabs, which is below hormal. Officials explained that their operations through May 6 had been hampered by severe ice conditions and the loss of many crab pots because of ice earlier in the season. They reported concentrating on tanner crabs because of poor king crab catches this year.

Fishing Only Pots

So far this year, the fleet has fished only with pots on a line 3,200 meters long with a pot every 25 meters. Normally the vessel anchors and her catcher boats fish within a 30-mile radius of her position. They concentrate on one area for about 10 days before shifting to a new position.

The crabs are taken aboard factoryship in slings (each holds 230 tanner crabs) and are unloaded on main deck aft of deck house. The crabs to be frozen--all tanner and some king--are first sectioned and then transported forward by a conveyor belt. There they are cooked in salt water for 18 minutes. Then they are cooled in salt water for 5 to 10 minutes and sent below decks for wrapping and freezing. The meat from the king crab, which are to be canned, is reportedly extracted by hand. The processing facilities are run 24 hours a day, if necessary, 7 days a week. Each crew member works 8 hours a day, 7 days a week.

* * *

JAPAN (Contd.):

230 TUNA LONGLINERS IN ACTION

Toward the end of July, about 230 Japanese longline vessels, home-ported at Yaizu and Misaki, were fishing for tuna in the Atlantic, Indian, and Pacific oceans.

In the Atlantic, the fleet numbered about 50. Twenty of these were fishing off Dakar, Senegal, primarily for bigeye tuna. Catch per vessel was about 1.5 tons per day of fishing.

In the Gulf of Mexico, 10 longliners were fishing for yellowfin; each vessel was averaging about 1.7 tons per day.

In the northwestern Atlantic east of New York, 6 longliners were fishing for albacore and bigeye. Catch per day was a ton a vessel.

East of Cuba, 5 vessels were taking albacore primarily at the rate of 1.2 tons per vessel per day.

Off Montevideo, Uruguay, 6 longliners were catching albacore and bigeye. Each was landing about 1.8 tons a day.

In Indian Ocean

In the Indian Ocean, 11 vessels were scattered. Off Cape Town, South Africa, 3 were fishing for yellowfin mixed with bigeye; the catch per vessel was averaging 1.4 tons a day. West of Java, each of 3 vessels was averaging about 1 ton per day of mixed bigeye and yellowfin. Near 30° S. and 80° E., 5 longliners were fishing for albacore and each was averaging 1 ton per day.

The Pacific

About 170 longliners were deployed in the Pacific. About 90 were fishing over a wide area between 0°-15° N. and 150°-170° W. (south of Hawaiian Islands). They were landing mixed catches of bigeye and yellowfin at the rate of 1.8 tons per vessel per day. Around the Galapagos Island, 12 were fishing for bigeye; each vessel was landing about 1.5 tons a day. In the southwest Pacific, 10 were fishing for yellowfin off the Solomon Islands, each landing 1 ton a day. In the region of 0°-10° S. and 100°-140° E. (around Indonesia and New Guinea), about 30 longliners were fishing for bigeye. The catch per vessel was about 2 tons a day, and as much as 3 tons for high vessels. Four longliners were working east of New Zealand. Five in the Tasman Sea off Sidney, Australia, were fishing for southern bluefin; catches per vessel were averaging 1.7 and 1.5 tons a day. ('Katsuo-maguro Tsushin', July 20.)

* * *

1971 CONSTRUCTION PERMITS FOR LARGE SKIPJACK TUNA VESSELS ROSE

In fiscal year 1971 (April 1971-March 1972), 279 tuna vessels were permitted to be built, an increase of 60 over FY 1970, reports the Japanese Fisheries Agency.

Construction permits for pole-and-line skipjack vessels totaled 115, nearly double the 64 built in FY1970. Increases for larger-sized skipjack vessels over 200 gross tons totaled 87. Of those, 35 were over 300 gross tons. There were none in that size category in FY 1970. ('Suisan Tsushin'. July 10.)

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NIHON SUISAN PLANS COMPUTERS TO SPEED FISHING OPERATIONS

Nihon Suisan, a leading Japanese fishery firm, has developed a "fishery and sea condition data retrieval system," first of its kind.

The company expects the system to provide high-speed answers to questions about oceanographic, meteorologic, and fishing conditions in any ocean.

Its motherships will radio questions regarding a particular location to the land-based Matsudo station for transmission to its Tokyo office. Its computer will answer the questions and relay these through Matsudo to the fleet.

To Speed Data Retrieval

The entire process is expected to take 15 to 20 minutes. About 20 kinds of inquiry forms will be prearranged, including data on water temperatures, salinity, sea currents, fish hauls, and weather. The new system will speed by several hundred times the present data-retrieval system, which uses technicians aboard the mothership. Already, the system has proved its worth aboard the company's whaling motherships in the Arctic and Antarctic. ('Japan Economic Journal', July 4.)

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JAPAN (Contd.):

PLASTIC FISH HABITATS DEVELOPED

The Plastic Waste Management Institute, formed by 35 petrochemical industrial firms, has made from waste plastics an artificial habitat for fish.

The fish home is made by melting a mixture of plastic wastes and sand at about 200° C. Then the material is molded into one-meter-square plates about 5 cm. thick with a square hole in the center. Two plates are connected with iron bars to make a unit.

The institute is considering a lattice-shaped structure made of waste plastics. About 300 such units would be sunk in the Inland Sea to test their construction.

Advantages of This Habitat

The institute says this type of fish home does not contaminate the sea. It is semi-permanent (in contrast to buses, cars), cheaper than concrete cubes, and solves problem of plastic waste disposal. ('Japan Times', June 27.)

NMFS COMMENT: Experiments on artificial habitats in the U.S. have shown remarkable success. Great numbers of fish are attracted to these homes where, previously, the waters were sparsely populated. However, U.S. experiments have been troubled by deterioration of such objects as cars and buses and/or high costs of longer-lasting concrete structures.

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ABALONE CULTURE

The Japanese cultivate abalone artificially, states "Australian Fisheries". Usually, the parent abalone are induced to spawn in mid-autumn by exposing them to air for a short time. Then they are placed in water a few degrees above or below seawater temperatures.

Vinyl plates are used as a home for the young abalone. These plates usually are left in seawater and accumulate a growth of microalgae used as food by the new abalone. Later, as the juveniles grow, they are fed with larger algae, such as Undaria sp., Laminera sp., and Ulva sp.

A year after fertilization, they reach about 20 mm. in shell length. Then, they are either sold to fishermen or released into unproductive areas of the sea around Japan. Within a few years, they reach marketable sizes and can be reharvested and sold.

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SUMMER ALBACORE LANDINGS NEAR RECORD

Japanese summer albacore landings for April-late June 1972 reached 45,000 metric tons. They approached the record seasonal catch of nearly 50,000 tons in 1971.

This year's monthly landings began at about 2,000 tons in April, rose to 18,000 tons in May, and jumped to 25,000 tons in June. Thereafter, catches began tapering off in the offshore waters. This indicated approach of season's end.

The size of albacore this year is very small. It averages 7-8 kilograms (15.4-17.6 pounds) per fish. As a result, meat recovery for canning is very poor.

Cold Storage Operators Active

The summer landings were being purchased heavily by cold storage operators. They obtained an estimated 40% of the catch for export. Frozen albacore export prices continue upward. At the end of June, they were reported to be around c. and f. US$850 a short ton for delivery to California. Because of rising prices, the packers in Japan were having difficulty competing for supply with cold storage operators. ('Suisan Tsushin', June 27.)

* * *

PAY $1,000 MORE FOR TON OF SHRIMP IN EARLY 1972

Japanese importers paid an average US$1,000 more per metric ton of frozen shrimp (about $0.45 more per pound) than they did in 1971.

The average import price of frozen shrimp from all countries has increased steadily in the past decade. In 1961, it was $1,682 per ton; by 1971, $2,583 ($1.17/lb). During Jan.-April 1972, it averaged $3,500 per ton ($1.59/lb), up $1,000 a ton over 1971.

* * *

JAPAN (Contd.):

TRAWLING OFF NEW ZEALAND IS LESS SUCCESSFUL

The "larder of plenty" for Japanese trawlers off New Zealand may not last much longer, reported the "Post Wellington" on June 7. In 1970, 8 trawlers harvested about 30,000 metric tons; 2,800 New Zealand vessels took 40,000 tons.

Five years ago, hauls of 30 tons or more were commonplace; today are a rarity. The Japanese soon may have to look elsewhere for new stocks of fish to replace their diminishing catches. Roughly 90% of their catch includes jack mackerel and barracuda, species not eaten in New Zealand.

2 Firms Active

Nippon Suisan operates three 2,500-GRT stern trawlers and one 1,000-GRT side-trawlers. Taiyo Gyogyo operates two 2,000-GRT trawlers year round off New Zealand; two other trawlers of the same size fish half the year.

Fishing Zone Extension Proposed

In late June, the New Zealand Fisheries Development Council proposed extending the 12-mile fishing zone to curb the "increasing rate of exploitation of the New Zealand fisheries area by foreign interests." The Council proposed too that, once fishing limit has been increased from 12 miles, a management zone extending to a least 200 miles offshore should be established. ('Asahi Evening News', June 29.)

日本

INDIA

INDIA'S FISHERIES OFFER INVESTMENT OPPORTUNITIES

India's fishing industry has been given more incentive to develop since it proved able to earn much-needed foreign exchange through increased exports. With a new emphasis on promoting exports of nontraditional products, India today is much more receptive to private foreign investments in deep-sea fishing than ever before.

The production outlook, according to a U.S. Embassy report, is favorable. Exploratory fishing was conducted on east and west coasts, the offshore grounds between 10 and 40 fathoms, excluding areas around Andaman and Laccadive Islands. These grounds are estimated to yield about 595,000 tons of fish and shrimp annually. Of this total, about 448,000 tons will be from Arabian Sea and 147,000 tons from the Bay of Bengal. Productivity studies estimate potential yield of demersal (such as sole) and pelagic fisheries (tuna, sardines, mackerel, white baits, anchovies, etc.) from seas around India up to 100-fathom contour to be about 2,288,000 tons.

Expanded Crustacean Production

Among commercial crustaceans, India will continue to offer expanded production opportunities primarily for shrimp and spiny lobsters. According to Government projections, the eventual export target for shrimp by 1978-79 is US $110 million; present level is about US$36 million. India will announce establishment of an autonomous organization, the Marine Products Development Authority (MPDA), to help achieve this target. This agency will assign priorities to the development of India's fishery potential. It will provide necessary operational and infrastructural resources.

Self-Imposed Constraints

There appear to be several self-imposed constraints on development of a modern fishing industry. Most important has been the inability of India's present fleet of about 12 vessels to fish beyond 40 fathoms. To correct this, and to increase production and expand exports, India recently decided to permit import of up to 60 modern trawlers with sensing devices, and processing and freezing equipment. Officials indicate that offshore fishing is now regarded as one of the "top priority" investment areas. India will consider favorably proposals from foreigners to establish joint ventures to develop and boost Indian exports of marine products, primarily shrimp.

SOUTH KOREA

S. KOREAN FISHING INDUSTRY GROWS REMARKABLY

During 1960-1970, S. Korea's fishing industry grew remarkably. Production almost tripled from 347,500 metric tons to 935,000 tons. Under 5-year expansion plan scheduled to start this year, production is expected to reach 1.6 million tons by 1976. Korea hopes to become the fifth largest fishing country; at present, it ranks 17th.

Fishery exports of South Korea scored an impressive 13-fold gain over the past decade. In 1971 alone, fishery exports reportedly reached US$120 million. This was 9% of the nation's exports of $1.35 billion.

Fleet Expands

Korea started deep-sea fishing, mostly for tuna, as early as 1956. During the past decade, the combined tonnage of fishing vessels more than tripled--from 107,000 tons in 1969 to 350,000 tons in 1970. By the end of Feb. 1972, the deep-sea fleet had increased to 369 vessels. It included 298 tuna longliners, 60 stern trawlers, and 8 transports. In 1971, longliners caught 117,000 tons of tuna, the third largest catch after Japan and the U.S. Fisheries Director Kim Dong-su is confident about exceeding 300,000 tons in 1976.

At present, Korea has no skipjack pole-and-line vessels. However, a few vessels will fish experimentally for skipjack this year. In time, Korean vessels will fish regularly for skipjack.

Overseas Expansion

Because of this rapid growth, Korea plans to increase its overseas fishing bases. At present, these include American Samoa, Las Palmas, and Tenerife in the Canary Islands (Spanish territory). It has agreed with Uruguay to use Montevideo and other ports as deep-sea fishing bases--and with Peru to use Lima. It is promoting fishery projects with Argentina, Indonesia, Brazil, and others. This includes joint investment projects in offshore and deep-sea fishing and technical tie-ups with its fishing partners. ('The Korea Times', May 7.)

TAIWAN

400 TUNA LONGLINERS ARE IN OPERATION

In mid-July, about 400 Taiwanese longliners (over 50 gross-ton sizes) were engaged in distant-water tuna fishing: about 175 in the Pacific, 122 in the Atlantic, and 98 in the Indian Ocean.

In the Pacific, most of the 175 longliners were off American Samoa. They were catching mostly albacore mixed with yellowfin and bigeye tuna. The catch per vessel was stable at 1 to 1.5 tons a day.

In Atlantic

In the Atlantic, over 90% of the 122 longliners were off Cape Town, South Africa. Their catches were predominantly albacore (about 80% of total) mixed with yellowfin and bigeye. The catch per vessel was running as high as 2.5 tons per day, but the average had declined to 1.3-1.4 tons.

About 98 vessels were in the eastern and western Indian Ocean. South of Madagascar, the catch was mostly albacore; the average was 1.5 tons per vessel per day. Off Jakarta, Indonesia, the catch per day was about 1.5 tons of yellowfin mixed with bigeye. ('Katsuo-maguro Tsushin', July 18.)

ASIAN TUNA CONFERENCE HEARS MANAGEMENT PROBLEMS

The sixth Asian tuna conference was held at Taipei, Taiwan, April 25-27, 1972. Japan, South Korea, and Taiwan were represented.

The delegates reported management problems confront their tuna fisheries. Vessel owners in South Korea and Taiwan are troubled by rising production costs. Because of this, Taiwan's private fishery operators have very little interest in building large tuna vessels; in South Korea, tuna vessels are not being built by existing enterprises.

The net meeting will be held at Seoul, Korea, in June 1973. ('Katsuo-maguro Tsushin', May 2.)

CANADA

BRITISH COLUMBIA TRANSPLANTS SALMON SUCCESSFULLY IN ATLANTIC

The experimental transplant of British Columbia pink salmon to Atlantic waters has been a success, according to Newfoundland Biological Station in St. John's.

A spokesman stated that 468 adult pink salmon, the third natural generation from eggs transplanted in North Harbor, St. Mary's Bay, returned to their natal river to spawn. Besides this run, marine scientists found that 117 pink salmon were caught in the commercial salmon fishery in St. Mary's Bay; 36 were found in rivers other than North Harbor River; 11 were taken in Hawkes Bay on the Great Northern Peninsula; and one other was recorded in the sport salmon fishery.

Canadian scientists reportedly are convinced that the pink salmon is definitely established in Atlantic waters. ('Canadian Fishermen', April 1972.)

SOUTH PACIFIC

AUSTRALIA

INVESTMENT PROSPECTS IN AUSTRALIA

About 20% of Australia's fishing industry is controlled by foreign interests, states a report by the U.S. Embassy on the investment climate in this industry. At present, U.S. private investment is exceeded only by Japanese. Kraft Foods Ltd. is the largest U.S. subsidiary participating in Australia's fisheries.

The prospects for future U.S. investment appear "mixed". Fishermen normally obtain both State and Commonwealth licenses. No new licenses are being issued for three types of "restricted fisheries"--abalone, rock lobster and scallops. Also, local interests have pressured the authorities not to allow any new "joint ventures." These are defined as enterprises employing foreign-owned boats and/or foreign crews. On the other hand, Australia continues to welcome foreign capital.

Issue Being Debated

The whole issue of foreign investment is being widely debated during this federal election year. While the fishery industry has not been singled out, many political figures, particularly in the opposition Labor Party, are calling for greater local equity in any new ventures.

Prospects for shrimp, rock lobster, scallops, abalone, and other desirable species appear generally good. Increased production and exports of shrimp seem especially promising.

* * *

U.S. AUSTRALIAN & JAPANESE PEARL VENTURE PROFITABLE

For the past 10 years, Pearls Pty., Ltd., a joint U.S.-Australian-Japanese venture, has profited in the culture and sale of pearls.

In 1971, the company sold 178,000 grams of cultured pearls (about 80,000 of them) worth US$3.6 million. The pearls, marketed by the Japanese partner, range in value from $4.20 to $2,520 a piece.

Oyster Farms

The pearls are grown on oyster farms at Kuri Bay and Thursday Island (northwestern Australia) and at Port Morseby (New Guinea). The Kuri Bay harvest is gathered from 120 hectares (about 296 acres) of water. This "farm" is seeded with 350,000 to 400,000 oysters. Another 160,000 are added every year as the oysters planted two years earlier are harvested. Twenty-six Japanese technicians are employed. ('Asahi Evening News', June 27.)

AFRICA

NEW GEAR SPEEDS SOUTH AFRICAN LOBSTER FISHERY

For many years, South African fishermen hauled in their lobster pots, emptied catch on deck, and later sorted it by hand. Many under- or near-legal-sized lobsters were damaged (broken claws, shells). Near-legal-sized lobsters also suffered greater exposure because they were the last to be sorted, measured, and released. About 50 million rock lobsters are examined each year only to be released because they are below legal size. This is time-consuming, expensive, and harmful to the smaller lobsters.

New Approach

The S.A. Sea Products Co., Hout Bay, South Africa, has developed a new approach. It has installed a "sorting grid" aboard its lobster vessels. This grid is used with special "escape" pots, which allow smaller lobsters to escape underwater, and has increased production appreciably.

The sorting grid is made of steel bars spaced 2 inches apart. It is mounted on the deck near the gunwale. A chute runs from the grid, through a hole cut in the gunwale rails, so undersized lobsters, falling through the grid, drop into the sea. The pots are unloaded into the grid.

An average 50-60% of lobsters in each pot escaped untouched through the grid; all were undersized. Between 2 and 4% of lobsters that remained were found later to be below legal size. In most instances, the process only took a few seconds.

Conservation

Through the use of special "escape" pots and sorting grids, lobster fishermen have aided conservation of lobster resources and speeded production. Fishermen no longer have to separate hundreds of undersized lobsters because it is done almost automatically. Fishermen using the grid can devote more time to ensuring freshness and quality of their legal-sized lobsters and increase fishing time. ('The South African Shipping News and Fishing Industry Review', Jan. 1972.)

CAMEROON FISHING INDUSTRY

Cameroon's fishing industry is largely a canoe fishery. In 1970, its catch was 70,800 metric tons (65,500 in 1969), mostly freshwater fish. Production has increased steadily since 1965. The shrimp fishery has grown most.

Cameroon has about 186 miles of coastline. Its continental shelf is up to 25 miles wide in the north and 15-20 miles in the south. Fishery resources on the shelf appear limited, except for shrimp. Sardinella, seabream, and tuna are found in adjacent waters and are fished commercially.

3 Types of Fisheries

There are 3 types of fisheries:

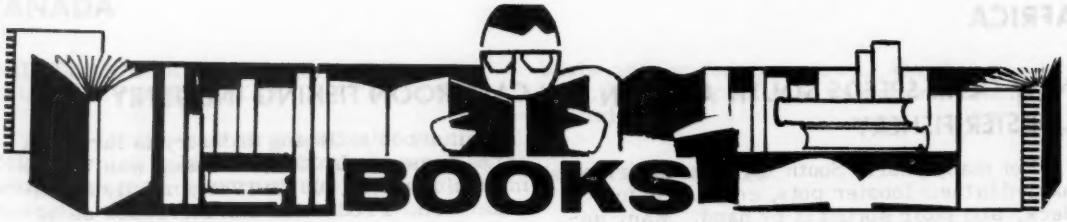
(1) Inland: This is most important, but it is canoe fishery and underdeveloped. The annual estimated catch is about 75% of total landings.

(2) Coastal: Fishing is conducted by an estimated 1,500 to 3,000 unpowered canoes. The catch is about 15,000 tons.

(3) Modern: Most vessels are in shrimping. They include 8 shrimp trawlers, 3 stern trawlers, 2 freezer trawlers, and 12-15 wooden, side-trawlers. Two Japanese shrimp trawlers joined the fleet in 1970-71 and the Cameroons eventually will buy these. The 1968 catch of the modern fishery was estimated at 15,000 tons.

5 Fishing Firms

There are 5 fishing companies. The two most important are: (1) SIPEC, a joint venture of the Cameroons, Spain, the Netherlands and, more recently, Japan. The company operates a modern 1,500-ton cold-storage plant, refrigerated freight cars and trucks, and 3 freezer trawlers. It was expected to buy two used Japanese 300-GRT shrimp trawlers. (2) SOPECOBA (or Crevettes du Cameroun), a joint venture established in 1968 of Cameroons and the U.S. firm, Gorton's of Gloucester. SOPECOBA has 8 steel shrimp trawlers and a freezing and packing facility at Port Douala; its shrimp exports to the U.S. topped $1 million in 1969.



"The Cod", by Albert C. Jensen, Thomas Y. Crowell Co., 666 Fifth Avenue, NYC 10019 $7.95

This is more than a treatise on the Common Cod. It is a unique look into our history through the economic and social thrust of cod fishing. It is a book written in a manner that will keep you reading to the end.

Albert Jensen, the author, is Regional Supervisor of Marine and Coastal Resources for New York State Department of Environmental Conservation. From the way he tells his narrative one can imagine him spinning fishing stories with the best of them.

Early in the book he sets the tone with banter about New England and the "Sacred Cod". He relates such amusing stories as the solemn procession that moved the carved wooden cod from the old to the new Chamber of the Massachusetts State House. He notes how 'cod' appears in literature and song. A sample from a scholarly work regarding the biology of the cod:

> The codfish lays a million eggs,
> The homely hen lays one.
> But the codfish never cackles
> To tell you what she has done.
> And so we scorn the codfish,
> While the humble hen we prize.
> Which only goes to show that
> It pays to advertise.

But this book is not just good humor. It is an informative discussion of the codfishing industry, how it developed, and where it is today. Mr. Jensen gives an interesting account of the cod itself, its prolific spawning, life expectancy, habitat, and some bizarre eating habits.

Studying ancient accounts, he speculates the Vikings were among the first to fish cod from our waters. He traces the evolution of the codfishing industry from the earliest New England settlers to today. The not-so-pure Puritans' Golden Triangle trade route is detailed: cod fish to Europe, slaves to the West Indies, and return with West Indian sugar and molasses for New England rum distilleries. The codfishing industry's part in the Revolution and later American history is narrated.

You glimpse the origin of Yankee stoicism as you read of life and fishing procedures aboard these boats--the long hours and tedious processes. It is a life style that changed greatly as the last American dory schooner gave way to the New England cruise ship.

Mr. Jensen includes information on the improvement of fishing methods over the years--from the introduction in 1878 of Norwegian gill nets to the floating factory trawlers being built today.

Statistics on yearly catches in commercial cod fishing and estimated catches in sport fishing are included. Many interesting pictures, diagrams, and maps are used.

Though he starts on a light note, Mr. Jensen ends with a very serious chapter on what is being done in conservation and management. He warns that much more needs to be done lest the historic cod disappear from the ocean.

AMERICAN RESOURCES

"Conserving American Resources," by Rubin L. Parson and Associates. Prentice-Hall, Englewood Cliffs, N.J. 07632. $11.95

A hopeful voice is heard in the pages of Professor Parson's 3rd edition on American resources. He says at the outset: "Conservation is an old theme that has been played many time before, but usually in a somber and depressing key. The present discussion is an optimisic variation on this theme...we predict that the American environment will be notably repaired and much improved during the useful life of this book".

Four groups of resources are discussed in this non-technical book: Perpetual--such

as air and water; Renewable--plants and animals; Nonrenewable--minerals; and Amenity--desirable attributes of our cultural environment.

He deals in great detail with population and resources; resource management of land, water and minerals; our forests and wildlife; resources for inspiration and recreation. The book includes many pictures and statistical illustrations.

Probably of greatest interest to readers of Marine Fisheries Review is the chapter, "Our Marine Resource Frontier". It is an appraisal of the vast marine resources, the threats to their well being, and how they should best be exploited and conserved. He discusses deep-sea mining, the fishing industry, and marine nonfood products. Bilateral agreements, the Geneva Conventions, and offshore territorial claims, are all reviewed. He indicates the great need for research and a new concern for these marine resources. He also tells what the National Marine Fisheries Service now is doing to protect and promote this aquatic wealth.

Parson makes a plea for the correlation of natural with cultural conservation. He believes that if we resolve to conserve our natural wealth with the same determination that has preserved our constitutional liberties we can be better off, despite a larger population by the year 2000.

FISH POPULATIONS

"Growth and Ecology of Fish Populations," by A.H. Weatherley, Academic Press, London and New York 1972, 293 pages, $13.50.

The author believes that growth in fish--and the ecological implications of this growth--has not received as much attention as other problems associated with fish population dynamics. "Yet growth is a major connecting link to all these problems."

He sets for himself two main tasks: to present valuable background information to the ecology of fish populations; to add to the growth biology of animals. He seeks to perform these tasks by providing a detailed understanding of growth in fish, their sensitive response to temperature changes, habitat, food supply, and other factors.

His book suggests simple models and schemes to dissect growth processes--production, the relation between growth rate of individual fish and age-specific fecundity, and predator/prey situations. Also, he outlines possible applications of systems analysis to successfully attack growth problems in the framework of populations.

Mr. Weatherley treats fish populations from the various standpoints of the ecologist--rather than the fishery biologist's more specialized ones.

SOVIET & CUBAN FISHERIES

"Soviet Seapower in the Carribean: Political and Strategic Implications," edited by James D. Theberge, Praeger Publishers, 111 Fourth Ave., NYC 10003.

All aspects of Soviet seapower in the Carribean are presented in 10 chapters that range across naval penetration, maritime activities, oceanography, and fisheries.

For Marine Fisheries Review readers, the final chapter, by Milan Kravanja, "Soviet and Cuban Fisheries in the Carribean," is of particular interest. Kravanja is a Foreign Affairs Officer, NMFS, and was a member of a U.S. fishery delegation to Moscow. He is a specialist in the expansion of Soviet fisheries.

In this essay, he details the rise and fall of Soviet fishery production over the last decade. He relates it directly to the expanding Cuban fishing industry.

Soviet-Cuban Relationship

According to Kravanja, the Soviets began their Caribbean operations in the early 1960s with just a few research and exploratory vessels. To fish commercially on a large scale, they needed a convenient 'home port'. The Cubans had needs too. They had nationalized their fishing industry. For economic and political reasons, they wanted to initiate distant-water fishing. They were more than willing to enter into an agreement by which the Soviet Union would supply money and know-how--and they would provide labor and a location for a suitable fishing port. Most of the fish caught by the Soviets were sold to Cuba, which resold them through its

nationalized marketing system to earn the money needed to pay local costs of building the port.

When the port was completed, Cuba began high-seas fishing and thereby reduced its need for Soviet-caught fish.

Soviets Gain Prestige and Foothold

The book explains how these developments affect the U.S. and the world, how the USSR uses its fishing fleet and port privileges in the Caribbean.

The author states that even though the Soviet fishing fleet in the Caribbean is by itself of no strategic--and of only minor political--importance, the Soviet Union did gain both political prestige and a strategic foothold in this fishery cooperation with Cuba.

The book includes statistics on port facilities, byproduct industries, the Radio Communications Center, and charts on yearly fish catches.

NEW FISHERY TRANSLATIONS

"Report on the Marine Fisheries of the U.S.S.R.," by Alain Parres, appeared in 3 parts in the French publication 'La Peche Maritime' in 1970 and 1971. It was translated recently in Tunisia for NMFS.

Mr. Parres is Secretary of the Federal Union of Fishing Vessel Owners of France. He based his report on a 10-day tour of Soviet fishery installations in October 1969 as a member of a delegation of French fishery officials.

The report details the economics, administration, and management of Soviet fisheries; disposition and location of fishing fleets and harbors; design, construction, maintenance, and operation of fishing vessels. Aspects of fishery technology, marine biology, and resources also are covered.

The 105-page report is sold for $7.50 per copy by the National Technical Information Service (NTIS), Springfield, Va. 22151, as COM 72 10488 (use this number when ordering).

"Crayfish", by Josef Kossakowski, was published in Warsaw in 1966. It was translated recently for NMFS. The 163-page book provides data on crayfish biology, including their internal and external appearance, environment, behavior, reproduction, food and feeding habits, development, diseases and natural enemies, and coexistence problem of different species. Also discussed are types of crayfish; catching gear and techniques; processing at time of catch; storage and transportation; management principles; role of crayfish in fishery production of inland waters; and outlook for crayfish production in Poland.

The translation is sold for $3 each by the National Technical Information Service(NTIS) Springfield, Va. 22151, as TT70-55114 (include this number when ordering). A limited number of copies is available free from NMFS. Write to: Translation Unit, International Activities Staff, NMFS, 3300 Whitehaven Street, Washington, D.C. 20007.

PAPERBACKS

New paperbacks on the market that may be of interest to commercial and sport fishermen alike are "Salt Water Fishing from Boats," "Advanced First Aid Afloat," and "Navigating and Finding Fish with Electronics."

"Salt Water Fishing from Boats" is a complete, illustrated, guide to the Atlantic, Pacific, and Gulf Coasts. It includes Bermuda and Bahama waters. The author, Milt Rosko, has written more than 400 articles on fishing and a book on bass fishing. He calls this new book a primer to help the fisherman know the proper equipment, the best locations, and the most appetizing bait. In unliterary but informative style, he covers everything from basic tackle to trolling, chumming, bottom fishing, casting, and landing your catch. There is a section giving thumbnail sketches of 'the life and times' of 50 favorite fish species, a very helpful glossary of fishing and ocean-related terms, and many pictures and illustrations. Collier Books, 866 Third Ave., New York, N.Y. 10022. $2.45.

"Advanced First Aid Aboard" could be very valuable gear to have aboard. Dr. Peter F Eastman is uniquely qualified to be the author.

He has drawn on his experience as a surgeon and doctor aboard an attack transport during World War II and as a volunteer consulting surgeon and physician for Care/Medico hospitals in developing countries. There he increased his knowledge of improvising surgical and medical care under limited conditions. He also has been an avid yachtsman for more than half a century.

With marked practicality, he gives immediate help inside the front and back covers with anatomical diagrams that he calls "Rapid Reference to recipes for Injury or Illness". In concise terms, and with explicit pictures and illustrations, Dr. Eastman makes it possible for the boatman to deal with a first-aid problem quickly and without panic. Symptoms and treatment are listed for such possibilities as fractures, sprains, burns, heat exhaustion, wounds and bleeding, mouth-to-mouth resuscitation, ulcers, gall gladder, the unconscious patient, dental emergencies, need for antibiotics and, of course, seasickness. Ten chapters cover more conceivable emergencies than could befall even the crew of the Flying Dutchman. Cornell Maritime Press, Inc., Cambridge, Md. $3.75

"Navigating and Finding Fish with Electronics" is a book that will be most helpful to the commercial fisherman, but holds much good information for the part-time or sport fisherman who would like the advantages of electonic aids while at sea. Diagrams explain ground and sky waves, line-of-sight transmission and directions finders and there is a great deal about equipment and systems.

There is OMNI, the standard radio navigation aid used by the aircraft of the United States; DECCA, the British-developed system; LORAN A, principal system operated by the U.S. Government for long-range navigation at sea; and the new OMEGA being implemented by the Navy for producing worldwide all-weather positions for ships. CONSOLAN is the limited system with one great advantage for the average fisherman: it needs no special receiving equipment. Any receiver that can be tuned to the proper frequency, and that contains a beat frequency oscillator, can use CONSOLAN.

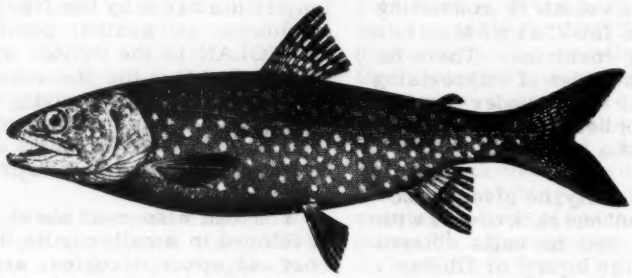
You can also read about RADAR newly developed in smaller units that, in terms of cost and space occupied, are quite suitable for fishing vessels and larger yachts.

A chapter is devoted to SONAR as a dual-purpose instrument for navigation and finding fish. Although not widely used in U.S. fisheries, SONAR is sure to be employed more as its use is understood. To this purpose, Mr. Dunlap tells about SONAR depth finding for ocean bottom fish, and SONAR horizontal scanning to locate schools of fish. He cites the National Marine Fisheries Service vessel, Oregon II, as one doing exploratory work in the Gulf of Mexico checking effectiveness of SONAR techniques for ocean fishing.

An important advantage of this book is that it lays out before the fisherman the many electronic choices with detailed information as to which system is most viable for his needs, what is necessary for greater yield, and how each system might help him in his pursuit of saltwater fish. It makes the point that even without vast electronic background these navigation aids can be used easily by ocean fishermen. This book is good reading for anyone interested in modern marine navigation, and particularly for those looking for a safer, more productive way to fish the oceans. International Marine Publishing Co., 21 Elm St., Camden, Maine 04843. $4.95.

--Laura Burchard

FOOD FISH FACTS



LAKE TROUT

(Salvelinus namaycush)

Lake trout, members of the salmon family, are the largest trout in North America. Lake trout are also known as namaycush, mackinaw, togue, longue, Great Lakes trout, and forktail trout, names given them by Indians, French Canadians, and other trout fishermen. The name namaycush is of Algonquin origin, a language stock spoken by many Indian tribes from Labrador to Carolina and westward to the Great Plains country. Lake trout are highly valued as commercial food fish as well as being sought after by sport fishermen.

DESCRIPTION

Lake trout vary widely in color with shades of gray and olive predominating. There are variations in the color of the flesh ranging from pale ivory to deep pink. It is thought that these color differences are probably determined partly by environment as well as heredity. Much of the body is mottled with light gray or whitish spots and these profuse markings extend over the head and on the deeply forked tail. Lake trout have the same moderately elongated body form shared by other trout and salmon. Head, eyes, and the mouth of these fish are large and the jaws are strongly toothed. All fins are without spines and the body is covered with small scales. Several races or subspecies of lake trout appear to exist, one found at moderate depths in the Great Lakes and in inland lakes, while another, the siscowet, frequents much deeper waters of Lakes Superior and Michigan. The siscowet, generally considered too oily for ordinary use, is usually smoked for market.

Size and growth rate of lake trout seem to vary from one body of water to another. Over the years, lake trout have established impressive records. The largest authentic angling record in North America was a 63 pound, 2 ounce fish caught in Lake Superior in 1952; and the largest on record, 49.5 inches long and weighing 102 pounds, was caught in Lake Athabaska, Saskatchewan in 1961. The average lake trout taken commercially is usually from 4 to 5 pounds.

HABITAT

Lake trout live principally in large, cool, fresh-water lakes of northern North America. Their range extends from Alaska eastward to the Labrador Peninsula, south to northern New England, and west through New York, the Great Lakes drainage basin, the northern margin of the Mississippi River watershed in Wisconsin and Minnesota, and the headwaters of the Columbia and Fraser Rivers and Vancouver Island, British Columbia. Lake trout have been successfully introduced into western lakes. These fish prefer deeper waters, as a rule; however, they move about extensively and may be found at any depth during certain seasons and in certain localities. Lake trout in the Great Lakes are usually more abundant at depths between 100 and 300 feet. Although they usually live at or near the bottom, they may sometimes be found in open water far offshore. In smaller inland lakes in the southern part of their range, the warming of the surface waters restricts them to deep waters in summer. Lake trout seldom school and even the young are scattered and seem to have solitary habits.

LAKE TROUT FISHING

Commercial fishing for lake trout in the Great Lakes is done almost entirely with the use of gill nets with a mesh size of 4-7 inches. A lesser amount is taken in gill nets with a 7-1/8 to 14-inch mesh. Most sport fishing is done by trolling; however, "bobbing" through the ice is a well-known and popular method with sportsmen.

CONSERVATION AND MANAGEMENT

The commercial production of lake trout in the upper Great Lakes fluctuated from a high yield to almost catastrophic collapse due to the invasion of the sea lamprey. Federal, Provincial, and State agencies of the United States and Canada worked together in an international body, the Great Lakes Fishery Commission, which was established by treaty in 1955, to overcome this disaster. Their combined efforts resulted in the discovery, by a scientist of the United States Department of Interior's Bureau of Commercial Fisheries, of a chemical that is toxic to sea lamprey larvae but harmless to other animal forms. This research, as well as the use of electrical and mechanical traps which intercept spawning lamprey, has resulted in a marked decrease in the sea lamprey population. Lake trout are increasing in the Great Lakes and there is hope that they will be soon restored to their former level of importance in the commercial and sport fishery.

Lake trout are being restocked in freshwater lakes with young fish raised in fish hatcheries. This enterprise has developed into a successful commercial industry in many states. Interest is also being shown in a hybrid variety, a cross between lake trout and brook trout called splake, which has potential for the future lake fishery.

USES OF LAKE TROUT

Lake trout have firm-textured flesh that is rich in flavor and very tasty. The white to pinkish tinted flesh is high in protein and is rather oily with high-energy value. Lake trout are available whole or filleted and may be baked, pan-fried, sauteed, or poached. (National Marketing Services Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio St., Room 526, Chicago, Illinois 60611)

Gill Net

SMOKY SEAFOOD SPECIALTY

Chances are ten to one that the man of the house never gets near the cooking operations in your kitchen except to peek and taste--all he's interested in are the tasty results. But at the outdoor-grill he's up and ready. He deserts the ball games on TV, digs out his chef's hat and apron and says, "Let's go!" If he hasn't tried smoke cooking on the grill, however, he's ready for an exciting new cooking method that will hold his interest throughout the season.

Let him show off to his heart's content. Have the instructions for smoke- cookery handy and the necessary ingredients available for him to start this project-- then sit back, relax, and enjoy.

Smoke cooking is different from ordinary grill cooking. It is a slower process, but the results are worth the added effort. Cooking with smoke adds additional flavor and an alluring aroma, and it is especially appropriate for cooking fish and shellfish. Any outdoor barbecue equipment with a hood may be used. With the hood the heat is above as well as below the food; it should be kept moderate to low, depending on the food and the recipe. Wet hardwood chips over the heated ceramic tiles (electric or gas grills) or over the glowing charcoal, lower the temperature and produce the smoke. (Use an oven thermometer with a charcoal grill.) Adjust the temperature according to the recipe used and follow grill directions.

Fish-Vegetable Medley, a new recipe from The National Marine Fisheries Service, is an excellent way to begin the smoke-cooking adventure. A clever foil package is the container for the food, going from grill to serving plate and keeping the food smoky hot while cutting down on clean up chores. Choose your favorite fish fillets and accent their delicate flavor with deviled ham--a new taste combination. Canned whole potatoes, onion, and mixed garden vegetables make this a complete meal-in-one. The sauce that enhances the mixture is condensed tomato soup. Fish – Vegetable Medley will emerge from the smoke oven with a tantalizing taste and an appetizing aroma. It's sure to win praise from family and friends and earn accolades for Dad as a backyard chef with imagination.

FISH-VEGETABLE MEDLEY

2 pounds fish fillets, fresh or frozen
2 teaspoons salt

$\frac{1}{4}$ teaspoon pepper

2 cans ($4\frac{1}{2}$ ounces each) deviled ham

1 can (1 pound) whole potatoes, drained
1 can (1 pound) whole onions, drained
1 box (8 ounces) frozen mixed garden vegetables
2 tablespoons lemon juice

1 can ($10\frac{3}{4}$ ounces) condensed tomato soup

Thaw frozen fish. Cut into serving-size portions. Cut six pieces heavy-duty aluminum foil, 12 by 12 inches each. Grease lightly. Place fish on each piece of foil. Season with salt and pepper. Spread deviled ham on top of each piece of fish. Divide remaining ingredients equally among the packages of fish, using the soup last. Bring the foil up over the fish and seal the edges by making double folds in the foil to confine the juices. Place the packages on the grill inside the smoke oven. Cook in a slow oven, 300 degrees F., for 15 minutes; open packages by cutting a crisscross in the top of each package and fold the foil back. Continue cooking for 10 to 15 minutes longer or until the fish flakes easily when tested with a fork, and the ingredients have a smoke flavor. Makes 6 generous servings.

(Source: National Marine Fisheries Service, National Oceanic & Atmospheric Administration, United States Department of Commerce, 100 East Ohio Street, Room 526, Chicago, Illinois 60611.)

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